# A HANDBOOK

OF THE

# LARGER BRITISH FUNGI

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BASED ON THE

GUIDE TO SOWERBY'S MODELS OF BRITISH FUNGI IN THE DEPARTMENT OF BOTANY, BRITISH MUSEUM (NATURAL HISTORY),

BY

WORTHINGTON GEORGE SMITH.

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# PREFACE.

THE object of this Handbook is to supply an introduction to the study of the larger British fungi. When considering the preparation of a new edition of the 'Guide to Sowerby's Models of British Fungi,' by the late W. G. Smith, which had served also as an introduction to the systematic study of the larger fungi, it was thought that its value might be increased by including all the British genera of Basidiomycetes. This has now been done, and additional figures have been added from Smith's 'Synopsis of British Basidiomycetes.' The Introduction has been greatly extended, the descriptions generally have been revised and enlarged, and additional matter of economic and biological interest has been included. Mr. Ramsbottom has, in fact, rewritten the book, while retaining the form and arrangement of the original 'Guide.'

The descriptions of species in larger type refer to those of which models are exhibited, or of which drawings are shown on the stand illustrating edible and poisonous fungi, in the Department of Botany. Descriptions in smaller type are of species not included in the 'Guide' and of which there are no models. They are, however, figured in the series of coloured drawings of British Fungi by W. G. Smith exhibited in the Department. The numbers in brackets after the names are those of the drawings, which in the case of the Basidiomycetes also correspond with those of the species in the 'Synopsis.'

Names in brackets, in italics, are of synonyms; their inclusion will serve to correlate the names used in the 'Handbook' with those employed in works where other views of limitations of genera have been adopted.

In dealing with the fleshy Agarics, the basis of selection has been on edible or poisonous qualities of the species. In this way a different selection of the less common forms has been made from that given in other elementary books. Edible merely means that the fungus has been eaten either in this country or on the continent without ill-effects; but experiments in eating fungi, the qualities of which are not previously known to the investigator, should be made with great caution.

In his Preface to the original edition of the 'Guide' (1893), Mr. Carruthers gave the history of the collection of models which was made by James Sowerby in the course of the publication of his 'English Fungi' (1797–1809). His purpose in their preparation was to exhibit to the public such a series of edible and poisonous species as would help to prevent the fatal mistakes so often made from eating poisonous fungi. His collection, consisting of more than two hundred models, was arranged in his house, and opened free to the public on two days each month. After his death the models were acquired, in 1844, by the Museum, from his son, James De Carle Sowerby.

The illustrations of the Hymenomycetes in the 'Guide' were from Stevenson's 'British Fungi,' by the kindness of the publishers, Messrs. Blackwood and Sons, Edinburgh; they are the work of W. G. Smith, who also prepared for the 'Guide' the illustrations of the other groups. We are indebted to Messrs. Blackwood for permission to continue the use of the blocks in the new book.

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*March* 1923.

# LARGER BRITISH FUNGI.

## (BASIDIOMYCETES & ASCOMYCETES.)

### DIAGNOSTIC CHARACTERS.

The Fungi treated in this guide are the larger forms. They belong to the several families of which the diagnostic characters are given below:—

Class I. BASIDIOMYCETES.—Spores borne on the exterior of more or less club-shaped basidia, usually in fours.

Order I. Hymenomycetes.—Spore-bearing surface (hymenium) exposed from the first or during development.

Family 1. *Agaricaceæ.*—Hymenium spread over the surface of radiating lamellæ or gills (p. 16).

,, 2. *Polyporaceæ.*—Hymenium lining the surface of tubes or reticulations (p. 117).

,, 3. *Hydnaceæ.*—Hymenium spread over spines or protuberances (p. 136).

,, 4. *Thelephoraceæ.*—Hymenium spread over a firm, smooth, or corrugate surface: sporophore usually resupinate (p. 142).

,, 5. *Clavariaceæ.*—Hymenium spread over the surface of smooth, simple or branched, erect clubs (p. 150).

,, 6. *Tremellinaceæ.*—Hymenium spread over a smooth gelatinous surface (p. 155).

ORDER II. GASTEROMYCETES.—Spore-bearing surface (hymenium) enclosed by a covering of sterile hyphæ (peridium) until maturity.

Family 1. *Phalloidaceæ.*—Peridium globose, with a middle gelatinous stratum; at length opening and exposing the contents (gleba) on a stalked or latticed receptacle (p. 161).

,, 2. *Lycoperdaceæ.*—Peridium usually globose and of two or more layers; dehiscing by an apical aperture or by the falling away of the walls; sterile threads (capillitium) present (p. 165).

,, 3. *Sclerodermaceæ.*—Peridium usually globose; dehiscing irregularly; capillitium absent or scanty (p. 170).

,, 4. *Nidulariaceæ.*—Peridium bell- or cup-shaped, containing compressed or globose peridiola each sometimes attached by a funiculus, free at maturity (p. 171).

,, 5. *Hymenogastraceæ.*—Subterranean; peridia globose, indehiscent; capillitium absent (p. 174).

CLASS II. ASCOMYCETES.—Spores contained in spherical to clavate asci, usually in eights.

ORDER I. DISCOMYCETES.—Hymenium exposed, usually on a more or less cup-shaped receptacle (p. 178).

,, II. PYRENOMYCETES.—Hymenium enclosed in a flask-shaped perithecium (p. 191).

,, III. TUBERACEÆ.—Asci enclosed in chambers within an indehiscent peridium; subterranean (p. 196).

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*Mycetozoa.*—These are not fungi, but form a distinct group. Spores usually borne within sporangia; on germination usually giving rise to swarm-cells which coalesce to form a plasmodium. No mycelial stage occurs.

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*Abbreviations used in the description of Species.*

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| Co. = cortina. | Re. = receptacle. |
| G. = lamellæ or gills. | S. = stipe or stem. |
| P. = pileus or cap. | T. = tubes. |
| Po. = pores. | V. = volva. |
| R. = ring or annulus. | |

C. = common, F. = frequent, O. = occasional, R. = rare.

Measurements give size of typical examples in inches: diameter of cap, length of stem, and width of stem about the middle.

# INTRODUCTION.

Fungi belong to the class of plants known as Cryptogams. The vegetable kingdom is divided into two great groups—one, flowering plants or phanerogams, which is characterised by forming seeds, the other, flowerless plants or cryptogams, which reproduces by spores. A spore differs from a seed principally in the fact that it does not contain an embryonic plant. The spores of fungi are undivided in the majority of cases, though they may have transverse or, very rarely, longitudinal septa also. They are usually elliptical or oval in shape, but sometimes spherical or spindle-shaped. Their contents consist of clear colourless protoplasm, which either completely fills the cell or leaves a space or vacuole containing a watery fluid; oil drops, which probably act as reserve food material, are often interspersed in the protoplasm.

Fungi differ from all other plants in their mode of life. An ordinary green plant obtains its food partly from the minerals which it absorbs from the soil, together with moisture, but more particularly by transforming the carbon dioxide of the air into starch. This it is able to do because of the green colouring-matter, *chlorophyll*, which is present principally in the leaves, the necessary factors being light, heat, and water. This transformation of inorganic material into organic is an essential link in the cycle of life, for without it life, as we know it, would be impossible.

The reason why fungi as a class have a different mode of existence from every other plant class is that they are without chlorophyll, and many species are able to develop quite normally in the dark. Green colouring-matter, it is true, occurs in certain fungi (e. g., *Stropharia æruginosa, Russula virescens*); but this is not chlorophyll, and is of no consequence in the metabolic activities of the organisms. Since, therefore, fungi are unable to manufacture their own carbohydrates, they have to acquire them in a manner recalling that adopted by animals. The two possible sources are tapped—both dead and living organic matter: those fungi occurring on dead or decaying matter are known as *saprophytes*, those occurring on living organisms are called *parasites*. It is owing to the necessary adoption of these modes of life that fungi are of such tremendous economic importance. Almost all rot and decay, and most disease both in animals and in plants, is brought about either by fungi or by bacteria—and bacteria are regarded by many investigators as being only a special group of fungi. The rotting of wood, fabrics, fruits, etc., the moulding of bread, jams, tobacco, is brought about principally by fungi. Fungi are the chief agents in plant disease, microfungi (such as rusts and mildews) causing millions of pounds worth of damage annually to crops, whereas the larger forms are the principal cause of the destruction of trees. Though bacteria play a much larger part in human

pathology than do fungi, the latter are not to be despised: such common diseases as "thrush" and "ringworm" are fungal in origin and many tropical diseases (as, for example, the ghastly "madura foot") are due to fungi. On the other hand, the scavenger properties of these colourless plants should be remembered, and also the work they do in preparing the way for other organisms. There is a whole flora in the soil, for example, which helps in the decomposition of organic matter, making it available for ordinary green plants.

In addition, the special physiological activities of certain fungi have been made use of in industry. The domestic and social uses of yeast are well known; there is also, for example, the less known use of various species of green mould (*Penicillium*) in the making of different kinds of cheese.

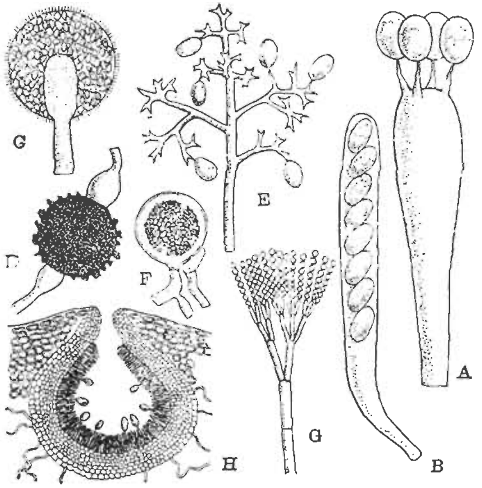


Fig. 1.—Spore forms. A. Basidiomycete; B. Ascomycete; C, D, E, F. Phycomycete—C asexual, D sexual (Mucor). E asexual, F sexual (Peronospora); G, H. Fungi Imperfecti (G, Penicillium. H, Macrophoma).

Fungi are classified according to the way in which the spores are arranged. The two groups treated in the following pages are:—

1. Basidiomycetes, which include mushrooms, toadstools, bracket-fungi, fairy clubs, etc., and which are characterised by having their spores borne, usually in fours, on the outside of basidia (A), more or less club-shaped structures which are usually closely packed together to form a definite hymenial layer. Mycelium septate.

2. Ascomycetes, which include morels, truffles, cup-fungi, ergot, etc., and which are characterised by having their spores usually in eights, borne within asci (B), more or less clavate structures which most frequently form a hymenial layer. Mycelium septate.

The other main group is:—

3. PHYCOMYCETES, which include the ordinary potato disease, salmon disease, mould of bread, etc., and which are characterised by not forming a definite tissue and by having an obvious sexual process (D, F). Mycelium usually aseptate and wider than in 1 and 2.

It should be further remarked that the basidium and the ascus are the so-called perfect stage of their respective groups, and correspond in the life-history to the structure resulting from fertilisation in the Phycomycetes. In the latter there are well-marked asexual stages, in which spores are borne either in indefinite numbers in swollen structures (*sporangia*) or on the ends of filaments (E). Sporangia are unknown except in this group, but the exogenous type of spore—*conidium*—occurs also both in Basidiomycetes and in Ascomycetes (G), sometimes being enclosed in flask-shaped structures (H). Very many fungi are known in which no definite perfect stage has yet been recognised. For convenience, these are all classed together as FUNGI IMPERFECTI, though this does not mean necessarily that the life-cycle of the fungus does not contain an ascal or basidial stage.

When a *spore* is placed in suitable conditions it germinates and, as a rule, gives rise to a germ-tube, which by apical growth becomes a long thread-like *hypha*. By continued growth, branching, and anastomosis an intricate mass of hyphæ is formed, which is known collectively as a *mycelium* ("spawn"). It is only with great difficulty that the spores of some fungi can be persuaded to germinate: germination-stages of others have never been obtained. An interesting point about spores is that, although they do not appear to have any special adaptations, many of them can withstand very severe conditions. For example, the spores of certain moulds (*Mucor*, *Aspergillus*), after being slowly dried, were placed in tubes from which the air was evacuated. The vacuum was maintained for a little over two years, during which time the tubes were subjected to the action of liquid air for three weeks and liquid hydrogen for seventy-seven hours. The spores readily germinated when they were afterwards sown on nutrient media. Recently a specimen of *Fumago vagans*, which had been preserved as herbarium material for sixty-seven years, was found to retain its vitality.

The mycelium often becomes dissociated into its constituent cells, which are then known as *oidia*. These are very common in certain fungi, particularly in agarics—in fact, Falck concluded that the oidium form is a definite stage in the life-cycle of many of the higher fungi. In some cases the whole mycelium becomes disarticulated, in other species only certain hyphæ produce oidia during a limited growth-period, while others still have more or less differentiated clusters produced in particular places (*Coprinus* etc.). The oidia of the first two types germinate readily and produce a mycelium: the most specialised type appears, in some species, to have lost the power of germination.

The mycelium in other cases may form *chlamydospores*; here the

contents of the cell round up and surround themselves with a thick wall.

In many fungi the mycelium becomes woven together and compacted into a solid mass, usually more or less globose and varying much in size in different species (*e. g.*, the size of a pin's head in *Typhula*, the size of a man's head in species of *Polyporus* and *Lentinus*). Sclerotia are apparently adapted to withstand inclement conditions: in favourable circumstances they reproduce the fruit-body. Several of the larger sclerotia were known for more than half a century before the fruit-body was recognised (e. g., *Polyporus Mylittæ*, the Australian Blackfellow's Bread), in others the fruiting stage is not yet known (e. g., *Pachyma Cocos*).

Mycelium may also become arranged in compact cord-like strands, which, from their frequent resemblance to roots, are known as *rhizomorphs* (cf. *Armillaria mellea*, p. 33).

**Fairy Rings.**—What are known in this country as "fairy rings," more or less circular rings of toadstools, recognisable when the fungi are absent by the darker colour and more luxuriant growth of the grass of the circle, have attracted popular notice in all parts of the world. A considerable amount of superstition grew up about them varying somewhat in different countries. That in England was that the circular growths marked the paths of dancing fairies (compare the description in Shakespeare's 'Tempest,' Act. V. Sc. 1). and that they brought good luck to houses built in fields in which they occurred. French peasants could not be induced to enter the rings because enormous toads with bulging eyes abounded there. In Sweden a person entering the ring passed entirely under the control of the fairies. In Germany the bare portion of the ring marked the place where a glowing dragon had rested after his nocturnal wanderings. A very prevalent belief was that such rings marked the presence of treasures which could not be secured without the aid of fairies or witches.

The earlier scientific explanations were almost as fantastic—thunder, lightning, whirlwinds, ants, moles, haystacks, animal urine, and such being considered the causal agents. Apparently it was not until 1796 that Withering ascribed them to a fungus, *Marasmius oreades* (see p. 112).

Many Basidiomycetes grow in fairy rings; probably the number of those described and those casually mentioned exceeds a hundred. The rings differ somewhat in type, but frequently they can be divided into three zones—an inner wider zone in which the grass and flowering plants are stimulated to luxuriant growth and darker green colour, a middle zone more or less bare of vegetation, and an outer narrow stimulated zone; in the case of some species little or no effect on the vegetation is apparent. Assuming a fairy ring to start from the germination of a spore, it is obvious that the progressive advance of the mycelium, in ordinary circumstances, will be more or less equal in all directions, and thus, at any given time, the extremities of the mycelial branches will occupy roughly a circle. Ritzema Bos likened the advance of a fairy ring to the progressive advance of a flame which results from the dropping of a match in dry grass, where, in the absence of wind, the flame spreads outwards in all directions. Fairy rings usually occur in poor pastures—that is, in soils which are rather low in organic content. The growth of the saprophytic fungus probably consumes the available supply of organic matter. The active fungal filaments are always on the outer edge of the ring, and

a turning back towards the centre would require a passage through a considerable distance of depleted soil (unless the mycelium first remains stationary for a number of years). This accounts for the fact that rings do not continue when they come into contact with each other, though smaller rings may often be found within larger ones.

Weather conditions, especially warmth and moisture, have their usual influence on the production of fruit-bodies, and more than one crop can occur in a year, or, on the other hand, no growth may appear above ground: Jordan records that a ring of *Clitocybe gigantea* fruited only once in fifty years.

Various measurements have been made of the rate of advance in the diameter of fairy rings. This rate is doubtless very unequal, and during dry years little, if any, advance is made. In *Marasmius oreades* Bayliss found the rate to vary from three to thirteen and a half inches a year. Comparing the size of the rings with the ascertained average yearly advance it seems probable that their age is often more than a century. Shantz and Piemeisel calculated that certain rings in Colorado were 250 and 420 years old; certain fragmentary rings, if they had a common origin (that is, if they did not arise by the junction of two or more rings) would be about 600 years old.

The development of the mycelium brings about chemical and physical changes in the soil. The results of investigations suggest that the following chemical changes take place. The dead organic matter of the soil is utilised as a food-supply by the saprophytic fungus. During the process the carbohydrates are consumed, or reduced, and parts of the protein material converted into ammonia. This combines readily to form ammoniacal salts, or is changed by bacterial action to nitrites, which are in turn converted to nitrates. The chief effect is, therefore, that the proteid portion of the organic matter of the soil is changed into compounds of nitrogen which are readily available to the higher plants. This results in an increase in plant-growth, the production of more roots in the soil, and consequently an increase in the organic matter in the soil. Similarly, in addition to this outer stimulated zone, an inner one is formed, owing to the fact that as the mycelium passes on to the new soil the older portion dies: decay brought by bacteria and moulds again liberates a supply of nitrogenous material for higher plants. The chief physical effect is the prevention of the penetration of rain water by the mass of fungal filaments, probably due to the air entangled within the meshes of the mycelial network, occupying the spaces between the soil-particles. Percolation through soil filled with mycelium is very slow, if the soil be once dried; when once dry it remains so, even through continued and heavy rains. This brings about a condition of extreme drought and a consequent dying out of the higher plants.

Thus the three zones in the rings may be accounted for where they occur: 1. (Outer.) Stimulation of growth, owing to the chemical action of the mycelium on the organic contents of the soil. 2. (Middle.) Death of vegetation, owing to drought brought about by the physical action of the mycelium. 3. (Inner.) Stimulation of vegetation, owing to the decay of fungus mycelium and carpophores and the consequent chemical changes.

Since fairy rings in lawns produce bare patches, irregular growths, and unequal colour, they are somewhat unsightly. The methods suggested for their eradication are: 1. Repeated stirring of the soil, especially during hot, dry weather, and exposing the soil to sunshine.

2. Application of fungicides, such as Bordeaux mixture, to the soil immediately over and a little in advance of the rings.

**Luminosity.**- The luminosity of decaying wood has been known at least from classical times, and is referred to both by Aristotle and Pliny; the latter also mentions the luminosity of an agaric which "grows on the tops of trees and shines at night: by the help of this light its presence is made known and it is gathered." Magnus (1652) mentions how in remote countries of the north the people collect luminous pieces of rotten oak-bark and arrange them at intervals in the woods through which they wish to go in the dark. Not only the bark but the rotten wood and the "Agaricus" itself are luminous. Besides this "street-lamp" use, the fungus, or rotten oak, is used as a "safety lamp" and taken where a torch would be liable to cause fire, as in barns of ripe corn and hay. Rumphius in his 'Herbarium Amboinense,' written probably about 1680, mentions a *Fungus igneus* which shines like stars with a bluish light and which the natives carry in their hand at night in order to see their way.

There are many other statements regarding the luminosity of fungi or of decaying wood. The women of New Caledonia use a luminous fungus as a decoration for their hair. In many places on the Western front during the war our troops found luminous wood useful for putting in the straps of their steel helmets and on the fore-sights of their rifles.

In the early part of last century it was surmised that the luminosity of decaying wood was due to fungi, because of the similarity of smell. It was afterwards proved often to be due to the rhizomorphs of *Armillaria mellea* (see p. 33), the subterranean strands of which had been observed to be luminous much earlier. It is interesting to note that Robert Boyle in 1667 worked at bio-luminosity, investigating the luminescence of decaying fish (which is due to luminous bacteria) and of "shining wood." He proved that air was necessary for the luminosity to be apparent, and tabulated a list of the resemblances between such wood and burning coal. Luminous bacteria are very common, and it has been suggested that the luminosity of wood may be due to them and not to the fungal hyphæ present in the wood. However, it has been shown that the rhizomorphs of *Armillaria mellea* grown in pure culture are luminous. Molisch confirmed this, and showed that it is the young rhizomorph covered with active mycelium which is luminous; as the rhizomorph becomes old and cuticularised it loses this property. Wood affected by *A. mellea* when brought indoors only continues to emit light for three or four days. On the other hand, a mycelium, of which the mature form is unknown (*Mycelium X*), retained its luminosity for one and a half years. *Xylaria hypoxylon*, which has repeatedly been reported to be luminous, failed to show this property in cultures. Another fungus which is stated to cause the luminosity of wood is *Chlorosplenium æruginosum*, a Discomycete which turns wood a verdigris green—such wood being used in the manufacture of Tunbridge ware.

Apart from the mycelium in wood, subterranean mycelium is sometimes luminous. As stated above, the underground rhizomorph of *A. mellea* has this property, and the mycelium of the Truffle is also said to emit light.

In other cases it is the fruit-body itself that is luminous. Smith records that both the mycelium and the fruit-body of *Fomes annosus*

are luminous, and that when growing on timber in mines they emit a light which can be seen for twenty yards. Other species occurring in this country, which are reputed to "phosphoresce," are *Panus stypticus*, *Polyporus sulphureus* (of which an old account states that it resembles flames of fire in darkness), *Corticum cæruleum*, *Collybia tuberosa* (sclerotium), *Collybia longipes*, and *Hiatula Wynneæ*.

The best-known European species is, however, *Pleurotus olearius*. Many other species of *Pleurotus* are luminous. In *P. japonicus* the light is emitted from the gills only, and these are uniformly luminous. The fungus emits a white light at temperatures from 37° F. to 104° F. In the absence of oxygen luminosity fails thus, in nitrogen it begins to fade after thirty seconds; exposure to oxygen causes no change in the amount of the light. The light can be observed at a distance of thirty-seven yards or more. Photographic images of the luminous surface are very faint, even after twenty-four hours exposure, but good white prints on dark background can be made of leaves placed between the luminous fungus and a photographic dry plate by an exposure of about two hours. Fungi, like bacteria, produce light continuously without stimulation: the light appears to have no biological significance in these cases; it is apparently fortuitous—an accompaniment of some necessary, or even unnecessary, chemical reaction. The luminosity of plants and animals (bioluminescence) is similar to the light produced during certain chemical reactions at low temperatures in the presence of oxygen (chemiluminescence). There are many other types of luminescence, *e. g.*, that produced by shaking, rubbing or crushing crystals (triboluminescence). It is extremely probable that luminosity in plants is of the same type as that in animals, which is all visible light and contains no infra-red or ultra-violet radiation or rays which are capable of penetrating opaque objects—as light it is the "most efficient" known.

**Mycorrhiza.**—It is now well-known that the roots of forest-trees often have the mycelia of fungi closely associated with them. The fungal hyphæ completely envelop the absorbing rootlets—which most frequently have a coralloid appearance and are without root-hairs,—and form a continuous sheath of densely interwoven hyphæ round them, including the tip; others pervade the surrounding medium in all directions. The combination of root and fungus is given the name *mycorrhiza*. The customary view of the relation between the fungus and tree is that it is one of *symbiosis*—that is, a living together of two organisms for mutual benefit. The fungal hyphæ are more efficient than ordinary root-hairs, owing to their quantity and their capacity for utilising the various constituents of the humus. The water and soluble inorganic and organic material absorbed by the hyphæ are passed on to the root-cells and thence to the ordinary conducting tissues of the root. More recently the balance of opinion seems to be that the fungus is more or less parasitic on the root, the degree of parasitism depending upon the biolo-

gical condition of the soil. The fungi concerned in all such cases (where the evidence is satisfactory) are Basidiomycetes, species of *Boletus*, *Cortinarius*, *Russula*, etc. It may well be that in those cases where certain species are usually found in definite stations, as *Amanita muscaria* near birches, *Naucoria escharoides* under alders, it is owing to their being the mycorrhizal fungus of the particular tree.

The association of fungus and root instead of being one in which the mycelia form a mantle outside the root (ectotrophic mycorrhiza) may be one in which the hyphæ enter the cortical cells of the root and form compact balls (endotrophic mycorrhiza). Such a type is characteristic of orchids, heaths, and other families. In a few genera the fungal hyphæ show clamp-connections, which suggests that in these cases we are concerned with Basidiomycetes. The fungus isolated from orchid roots and grown in pure culture forms sclerotia, which in some forms closely resemble *Rhizoctonia violacea*, which attacks potatoes and other crops and is an imperfect stage of a species of *Corticium*. An interesting point in connection with orchids is the fact that their seeds will not germinate under ordinary conditions. If, however, they are sown in soil containing the root-fungus (or on a culture of the fungus) the hyphæ penetrate into the cells of the seed, and germination takes place (*cf.* also *Armillaria mellea*, p. 33).

**Change of Colour in certain Species.**—The flesh of many fungi changes rapidly in colour when broken. The phenomenon is well marked in the genus *Boletus*, where the flesh becomes green or blue (*B. satanus*, *B. luridus*), pink, red, or vinous (*B. felleus*, *piperatus*, *edulis*), and so on. Certain other genera (*Lepiota*, *Psalliota*, *Lactarius*) include species which show colour-changes in their flesh, and in the last genus the milk of many species changes colour on exposure to air.

Bourquelot and Bertrand studied this question. It had previously been shown that the juice from *Boletus luridus* has the power of turning tincture of guaiacum blue, and that it loses the property on heating. Many species were examined by using a weak tincture of guaiacum resin on the flesh of the various parts of the fruit-bodies. It was found by this test that all the species of *Russula* examined, and most species of *Lactarius* contain an oxydising enzyme (? laccase), whereas certain other genera have few or no species thus endowed; further, the enzyme may be located in a definite portion of the fruit-body, or it may occur only when the fungus is young. It is when this oxydising enzyme and a substance which colours on oxidation are both present that a change of colour occurs. By boiling portions of *Boletus cyanescens* in strong alcohol a liquid is obtained which is slightly tinted yellow. This remains unchanged in air, because the oxidising enzyme is killed by the heat. If to this alcoholic extract the juice from some other fungus (such as *Russula furcata*) be added, the liquid shows a slight purple tint after half a minute and rapidly changes to blue. If the liquid is not agitated, the surface in con-

tact with the air first shows the colour and the deeper shades. The solution therefore much resembles tincture of guaiacum, and is coloured blue by a number of oxidising agents, such as lead-dioxide. Similar results were obtained with *Boletus luridus* and *B. erythropus*, though in these cases the alcoholic extract will not remain unchanged for so long a time, *e. g.*, it loses its power in six weeks in the former.

*Lactarius flavidus* has both a colouring-matter (chromogen) and an enzyme in its milk: the two in the presence of air bring about a change of colour from white to violet. The chromogen is soluble in alcohol: the solution becomes violet on adding the juice of *Russula furcata*.

In the case of *Russula nigricans* there is a difficulty in that the colouring-matter is not soluble in alcohol. If the hot alcohol is decanted off and boiling water poured on the residue, allowed to cool, and filtered off, it is found to contain the chromogen. If the enzyme be added as in the previous cases, the liquid changes from red to black, though this takes time. The chromogen in this case can be crystallised.

Bertrand has more recently given the name boletol to the chromogen of *Boletus*, and regards it as a phenol acid. As when a solution of boletol in water is treated by laccase the coloration is irregular and difficult, he holds that the boletol must be accompanied in the fungus by other substances. The blueing of *Boletus* requires six different factors:—1. Oxygen and boletol; 2. Laccase and manganese (which is usually carried with it); 3. Water, which acts as a solvent, but particularly as an agent of hydrolysis; 4. Alkaline metals, magnesium, or alkaline earths. The product of the different colours in the flesh of certain species of *Boletus* is explained by the fact that organic compounds of boletol are reddish, whereas metallic combinations are blue. If the alcoholic extract which has turned blue be acidified, the "boletolquinone" is set at liberty and the colour immediately changes to red.

**Poisonous and Edible Fungi.**—Fungi have probably been eaten from prehistoric times. Classical literature has constant references to both their edible and their poisonous qualities. Pliny states that fungi are "the only food which dainty voluptuaries themselves prepare with their own hands and thus, as it were, by anticipation feed on them, using amber knives and silver service." Martial in a well-known epigram says "Gold and silver and dresses may be trusted to a messenger but not boleti." Another epigram attributed to Martial, on the death of Macrinus, says "Defungi fungis homines, Macrine, negabas; boleti leti causa fuere tui."—"You were wont to deny, Macrinus, that men could be killed by fungi; yet Boleti were the cause of your own death."

In this country only the field-mushroom (*Psalliota campestris*) and the horse-mushroom (*P. arvensis*) are commonly eaten, though some of the other edible species were on sale in Covent Garden in former days. In fact, it would not be exaggerating to say that for most people the cultivated variety of the field-mushroom is the only edible fungus. This is much to be regretted, as many of our common toadstools are far more delicate in flavour than either of the above.

Indiscriminate eating of toadstools is, however, not a pastime to be indulged in, for, although there are far fewer poisonous species than is popularly supposed, some of them are extremely dangerous, causing intense agony when eaten, and even death. The only safe

way in which to know whether a fungus is edible or poisonous is by being able to distinguish it in the same way as one does other edible plants, and to ascertain its record. *There is no other way.* It is generally supposed that by subjecting a fungus to one or other simple test it can be easily ascertained whether it may be safely eaten. Though the belief in many of these tests is common throughout the world, *not the slightest reliance can be placed upon a single one of them.*

Some of these beliefs, several of which have survived since classical times, are :—

1. Poisonous fungi have either a repugnant appearance; are viscid; do not "peel"; are green, red, or white in colour; have a fœtid odour; have a sharp bitter taste; exude a milky fluid when broken; have their flesh rapidly turning colour when broken. *Every one of these characters occurs both in poisonous and in edible species.*

2. A fungus that has been nibbled by rabbits, squirrels, etc., or which is slug-eaten, is edible. *Slugs thrive on* Amanita phalloides, *the most poisonous fungus known.* (It may be added that the experimental evidence acquired by feeding domestic animals on doubtful species is not absolutely trustworthy.)

3. Fungi which blacken a silver coin or silver spoon when cooking, which coagulate milk, which turn an onion bluish or brown, or which make parsley leaves yellow, are poisonous. *This is not true: and, further, fungi which do not act in any of these ways are not necessarily edible.*

4. Fungi which grow on highly manured places are poisonous. *Such fungi may either be poisonous or edible, e. g., the common mushroom.*

The remaining "rule of thumb" methods are equally useless. The only way in which to benefit by the experience of others is by learning to recognise the species concerned.

Many writers give general rules as to the kinds of fungi to avoid, such as those with a volva, those with pink spores, those growing in woods, etc. These rules are of little value, not so much because they exclude many well-known esculents as that they give a false sense of security. *The one golden rule is not to eat a fungus until its identity is certain.*

The poisonous effects of fungi may be classed under four headings:—

1. *Natural idiosyncrasy.*—It should be remarked that many people are unable to eat fungi of any description without discomfort. This is analogous to the well-known cases of inability to eat eggs, strawberries, etc. It may be that the idiosyncrasy in some persons is special to certain species.

2. *Simple indigestion.*—Fungi which are perfectly fresh and wholesome may prove indigestible even to those whose digestive powers are in no wise defective. Faults of cooking or sometimes over-indulgence are the most frequent causes. It is unwise to partake of a heavy meal of fungi on returning from a long walk, fatigued and

hungry: in no case should fungi be eaten unaccompanied by other food such as bread or meat. Fungi must be considered as somewhat indigestible, portions traversing a normally functioning digestive tract practically unchanged.

3. *Poisoning by old and altered fungi.*—Fungi should always be eaten soon after gathering (though many species may be dried for future use). As in the case of all organic substances changes soon set in, brought about by bacteria and moulds. A fungus in which the gills or pores are altered by parasitic attack should never be gathered for the pot. No one would think of eating meat that was not fresh (unless frozen) or fish or fruit from a "blown" tin. The poisoning occasioned by partly decomposed fungi is of similar nature to ptomaine poisoning. Old fungi and those burrowed by larvæ should be rejected.

4. *Specific poisoning.*—Many fungi are extremely poisonous. Those occurring in this country, of which we have definite information, are indicated in the following pages.

The fungi containing specific poisons are classified by Koch as follows:—

1. Those containing substances which excite the muscular apparatus, especially smooth muscular fibres (uterus, vessels, etc.): e. g., *Claviceps purpurea* (ergot).
2. Those containing hæmolytic substances, that is, substances attacking especially the red corpuscles of the blood: e. g., *Gyromitra esculenta*.
3. Those containing irritant principles which bring about gastro-enteritis by direct action on the mucous lining of the intestines: e. g., acrid species of *Russula* and *Lactarius*, *Entoloma lividus*.
4. Those containing a substance which paralyses the central nervous system: e. g., *Amanita muscaria*.
5. Those which, after a long incubation-period, bring about the degeneration of the cells of the organism, particularly those of the nervous system and glandular parenchymatous cells, especially of the liver: e. g., *Amanita phalloides*.

The poisons of the first three groups are apparently eliminated during cooking: also, in many cases, by drying.

A method which is supposed to render all fungi harmless is used in certain parts of France. It consists in "blanching," that is, bringing them to the boil in water with a little salt, or after previous treatment with salt or vinegar. The poisonous substances are extracted by the water, which is thrown away. The fungus is wiped and then cooked. Fabre's 'Life of the Fly' gives an account of the process as used in the neighbourhood where he lived, and as the translation is deservedly popular in this country the knowledge of it has become broadcast. The method is regarded by competent French mycologists as completely untrustworthy.

**Fungi as Food.**—During recent years the question as to the nutritive qualities of fungi has been raised in most civilised countries in a much less academic way than formerly.

Numerous analyses have been made of edible fungi. The table given below gives a *résumé* of a number of such analyses, but, although these vary for different species, there is considerable variation in the figures given for the same fungus, possibly to some extent owing to the composition varying with age and differing in different parts: a

young specimen is more nutritious than an old one, the cap more nutritious than the stem.

In considering the value of a food it is necessary to know its chemical composition and also the digestibility of the substances it contains.

The chemical composition of edible fungi is roughly:—

Water from 80 to 90 per cent.

Proteid-nitrogen: from 2 to 5 per cent., of which a proportion is indigestible.

Carbohydrates: fungus-cellulose (about 3 per cent.), sugars (trehalose about 4 per cent., mannite about 1 per cent.), glycogen.

Fat about 1 per cent. (lecithin).

Mineral matter, chiefly potassium salts and phosphates, from $\frac{1}{2}$ to $1\frac{1}{2}$ per cent.

Many of the earlier analyses regarded the total nitrogen content as representing digestible proteid substance, and thus gave a false idea of the value of fungi as food. It is now known that a considerable portion of this nitrogen is non-proteid, and, further, that probably as little as one-third of the proteid may be digestible.

In the amount of water they contain fungi resemble green vegetables. During cooking, of course, part of the water is driven off, and consequently the proportion of nutrient is increased. Fungi are a complete food: this we also know from the fact that certain experimenters have existed solely on them; and in certain regions, either where the country is infertile or where the natives are of low mentality, fungi form the main food, as in Fuegia, where *Cyttaria* is the staple food during many months of the year. But the amount of nutrient in them is so small, when compared with their bulk, that purchased fungi cannot be regarded as an economic proposition from a food standpoint. Their chief value is that they act as appetisers, giving variety and flavour to other more nutritious foods.

**Ecology.**—Since fungi are either parasites or saprophytes, it follows that their distribution is dependent upon that of other organisms. In the case of parasites it is necessary that the particular host be present, and in the case of a saprophytic fungus a special medium is affected. This is well seen in the larger fungi, where many trees have their peculiar parasites and where the saprophytic species are often restricted to certain types of humus, to burnt ground, to dung, etc. Consequently the different types of woods have characteristic species, and in those cases (beech woods, pine woods) where flowering plants are practically absent from the ground-flora fungi are the dominant constituent. The older divisions into pasture-loving species, those of coniferous woods, and those of deciduous woods can be subdivided to correspond to the modern ecological associations, each with a characteristic facies.

# Class I. BASIDIOMYCETES.

The characteristic feature of the Basidiomycete is the basidium. This is, in most cases, a more or less club-shaped structure, bearing four spores. Though the spores typically number four, a range from two to eight occurs. A much more important difference is, however, the fact that the basidium may be longitudinally divided or transversely septate; and further that the spores in these cases produce sporidioles (small spores) on germination. Recent classifications of Basidiomycetes take account of basidial division and sporulating germination, but the older arrangement into Hymenomycetes, where the hymenium is exposed either from its first appearance or during the development of the fruit-body, and Gasteromycetes, where it remains enclosed until maturity, is retained here.

The mycelium of Basidiomycetes is characterised by the presence of clamp-connections. These are formed by the outgrowth of a papilla from the wall of the hypha (some distance from the tip), which curves backwards and applies itself with a slight twist to the wall behind it: at the point of contact the two membranes dissolve. Meanwhile, a wall appears midway in the hypha followed by a second one separating the base of the clamp from the parent hypha.

**Cytology.** In the young basidium two nuclei are normally present. As the basidium ages these nuclei fuse. The fusion-nucleus then undergoes two successive (reduction) divisions and the four resulting nuclei pass through the sterigmata [1] into the developing spores. The two fusing nuclei are found to arise by the conjugate division of paired nuclei, which are present in the cells of the trama [1] and in the secondary mycelium. The question as to the origin of the pairing of these nuclei is one of great theoretical interest. (In the Uredineæ the pairing arises at the base of the æcidium by the "fusion" of two adjacent uninucleate hyphæ.) In a few cases (e. g. *Hypochnus terrestris*), the nucleus in the young spore divides so that the mature spore is binucleate.

Quite recently a considerable amount of light has been thrown upon the question. It is well known that in the Mucorineæ strains exist, and unless the hyphæ of two different strains meet no sexual organs are formed. Bensaude (1918) has shown that similar strains exist in *Coprinus*. A single spore culture of *C. fimetarius* remained sterile, its nuclei were not paired, and there were no clamp-connections. When several spores were sown, fruit-bodies were produced, the nuclei were paired and divided conjugately, and these divisions were accompanied by the formation of septa with clamp-connections. Kniep (1919) has added the remarkable observation that, although a species is heterothallic, either of the strains may fruit: the fertile fruit-body produced from a single spore does not differ externally from that produced from two monosporous mycelia of opposite "sex"; the difference is seen in that there are no paired nuclei—in the haploid basidium the single nucleus divides twice to give the spore-nuclei, whereas in the diploid basidium the two nuclei fuse before the two divisions. All the spores produced from a fruit-body of monosporous origin are of the same sex.

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[1] Compare figure 3.

# Order I. HYMENOMYCETES.

## Family I.—AGARICACEÆ.

In this family the hymenium is arranged in radiating plate-like gills. The accompanying illustration (fig. 2) shows the chief parts of an Agaric (*Amanita phalloides*). A is the cap (*pileus*) from which the gills (*lamellæ*) BB depend. C is the stem (*stipe*), furnished with a ring (*annulus*) at D and a *volva* at E. In the early stages of this species the volva (universal veil) encloses the whole plant (FF); during expansion it becomes ruptured, and sometimes patches of it, GG, remain on the cap. The ring, D, similarly, is part of a membrane (*partial veil*), which in the young stages connects the edge of the cap to the stem and is ruptured by the expansion of the former.

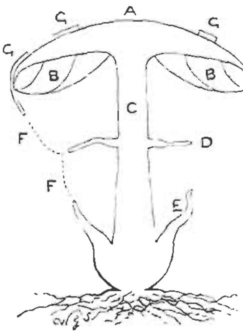


Fig. 2.—Section of *Amanita phalloides* Link (one-third natural size).

If a transverse section be taken across the gill of an Agaric and examined under a microscope, it will be seen to consist of a middle portion bordered by the hymenium. The middle portion is known as the *trama*, and is composed of hyphæ, which lie either parallel, converge, or diverge along the median axis, or are irregularly interwoven; running out obliquely from the trama are shorter cells, which form the subhymenium; the cells of the hymenial layer are arranged at right angles to the longitudinal axis of the gill.

An analysis of the structure of the hymenium shows that amongst the basidia there occur cells usually of similar shape, but which do not bear spores; these are known as *paraphyses*, and probably act as spacing agents. In certain genera structures of different shape also occur, which are termed cystidia, and of whose function no satisfactory explanation is yet forthcoming (*cf.*, however, *Coprinus*, p. 81). The basidium is usually somewhat clavate in shape and has four projections (*sterigmata*), which are exceedingly narrow at their tips, on each of which a spore is borne. If the cap of a mushroom be cut off from the stem and placed on a piece of paper with the gills downward, and left overnight covered with a tumbler, the spores liberated fall vertically downwards and produce a "spore-print" of radiating lines corresponding to the spaces between the gills; if the cap be left uncovered in a disturbed atmosphere, the print is blurred. Buller has shown that the spores do not simply fall from the basidium. A few seconds before the spore is abstricted a drop of water appears at the tip of the sterigma. This drop usually has a diameter about half that of the spore and is carried off by it; the spore is therefore

very adhesive when first liberated. The spores of a basidium do not leave simultaneously, but successively within a few seconds or minutes of each other. Each spore is shot off violently to a distance of about 1/250 inch. The propelling force seems to be provided by the pressure of the cell-sap of the basidium upon the cell-wall, and possibly by a similar pressure in the spore; the sterigma breaks across, but does not open. The motion is at first more or less horizontal in the spaces between the gills, but is very rapidly brought to an end owing to the resistance of the air. In consequence of this, and also of the attraction of gravity, the spore describes a sharp curve and then falls vertically downwards. The fall is most rapid between the gills;

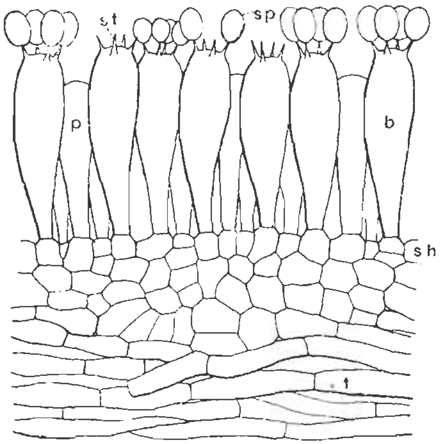


Fig. 3.—Transverse section of gill-surface. *b*, basidium; *st*, sterigma; *sp*, spore; *p*, paraphysis; *sh*, subhymenium; *t*, trama.

after emerging the spore becomes dry within about a minute, and the consequent diminution in volume causes a considerable reduction in the rate of fall, which depends upon the size and specific gravity of the spore. The rate of fall varies from about 1/80 inch per second in the case of very small spores to about ¼ inch for large spores. The importance of the violent spore discharge lies in the fact that the very adhesive spores are prevented from touching each other or any part of the hymenium whilst escaping from the fruit-body. In connection with this it is of interest to note that in the mushroom it was calculated that when two adjacent gills are tilted from their vertical planes to an angle greater than 2° 30′ some of the spores are unable to escape from the interlamellar spaces; with a tilt of 5° half the spores are lost and with a tilt of about 9° 30′ four-fifths of them. Most species of Hymenomycetes have rigid fruit-bodies, a fact which is of considerable importance in keeping the planes of the gills, the

axes of the tubes, etc., in vertical positions. Further, the gills of many species are positively geotropic and quickly respond to the stimulus of gravity; the younger the fungus and the smaller the tilt the quicker and more complete is the readjustment to a vertical plane.

Spore-discharge from any fruit-body under normal conditions is continuous, and does not appear to be affected by light conditions nor by changes in the hygroscopic state of the atmosphere. In certain cases it goes on for weeks. Oxygen is necessary for spore-discharge: in its absence the process immediately ceases. The number of spores liberated by large fruit-bodies is astonishing. A mushroom three inches across was found to produce 1,800,000,000 spores; a fruit-body of *Coprinus comatus* 5,000,000,000 and one of *Polyporus squamosus* 11,000,000,000. It was estimated that a large specimen of *Lycoperdon Bovista* contained 7,000,000,000,000 spores. In considering these colossal numbers it should be remembered that many fruit-bodies often arise from the same mycelium and also that a mycelium may be perennial; thus *Polyporus squamosus* occurs on the same stump many years in succession and *Lycoperdon Bovista* often forms "fairy rings." Since we must assume that the number of individuals of a species remains more or less constant, it is necessary to admit that on an average only one spore produced during the life of a perennial mycelium is successful in finding conditions under which it will germinate and come to maturity.

**Development.**—The initiation of fruit-body formation is indicated by the appearance of small undifferentiated compact masses of interwoven mycelium, usually somewhat elliptical in shape. In those cases where a ring or (and) a volva is present the gills develop *endogenously*. There are specific differences displayed in development, but the general course of events is similar. The hymenophore rudiment shows first, in longitudinal section, as a patch of heavily staining hyphæ on each side—that is, it forms an annular area within the fruit-body. This area increases in extent, and many hyphæ grow from its upper portion downward to form the primordial layer of the hymenium. These hyphæ are slender and pointed, and are consequently able to push between the surrounding hyphæ. The rapid growth of the hyphæ of the rudimentary pileus together with the cessation, or at least the slowing down of the rate of growth of the ground-tissue below this primordium causes the formation of an annular gill-cavity, which is at first very minute, but enlarges rapidly. Meanwhile, the downward-growing hyphæ push into the cavity and form the gills. (No internal annular gill-cavity is formed in *Amanita* and the hymenophore does not originate as an even palisade-layer of short hyphæ. The primordia of the lamellæ originate at several points in the fundamental tissue between the apex of the stem and pileus, in the form of radiating plates or trabeculæ.)

The pileus, hymenium, and the upper layer of the stipe are formed by the differentiation of a small central layer of tissue. The species so far investigated can be grouped according as to whether

1. The pileus primordium is differentiated first (*Hypholoma*, *Amanita*, *Amanitopsis*, *Tubaria*),
2. The stem primordium is first differentiated (*Lepiota*, *Pholiota*, *Cortinarius*),
3. The hymenophore primordium first appears (*Psalliota*, *Armillaria*, *Stropharia*).

In the early stages of development there is an enveloping zone of loose-meshed

tissue with stout hyphal walls. This is the "universal veil" or blematogen. (In certain species of *Psalliota* there is an additional universal veil, the protoblem, which lies outside the blematogen and consists of a delicate, floccose, loose layer, soon becoming torn into patches, which sometimes remain after the complete expansion of the plant.) In *Amanita* and *Amanitopsis* a cleavage-layer is formed on the surface of the pileus, between it and the universal veil, which frees the latter to produce the volva: in *Psalliota* the blematogen remains concrete with the surface of the cap.

The partial veil is not merely a portion of the universal veil. The upper and inner portion is formed by the downward and inward growth of the margin of the pileus primordium; the lower portion is formed by the increased growth of the hyphæ on the surface of the pileus: a slight external remaining portion is derived from the thick-walled hyphæ of the blematogen at this point, which may be more or less completely sloughed off or remain only as scattered portions on the surface of the annulus.

In *Amanitopsis* as the plant expands, the edges of the gills are torn free from the fundamental tissue covering the gills. As the stem elongates, this remains as floccose patches on its surface. These patches correspond to the partial veil. In *Tubaria* the partial veil ruptures irregularly at maturity, and is so delicate that it soon disappears.

The cortina in *Cortinarius* is made up of two elements—the blematogen on the outside, which extends from the upper surface of the margin of the pileus to the stem, and the inner threads, consisting of the fibres of the partial veil.

In the genera recently studied which show *exogenous* development (*Clitocybe, Omphalia, Mycena, Hygrophorus, Entoloma*) the general course of events is that the pileus primordium is differentiated by the divergence of apical hyphæ, which grow outwardly and laterally, and can thus be distinguished from the primordium of the stipe. The primordium of the hymenophore is differentiated simultaneously or a little later, and arises at the annular groove between the pileus and stem fundaments. It is characterised by crowded, narrow, usually pointed hyphæ and by an irregular surface. By continuous branching a definite layer of parallel threads perpendicular to the surface is formed, and by the enlargement of the cells of these hyphæ and the evening up of the hyphal elements a level palisade is produced. The primary lamellæ originate from this layer as evenly spread radial folds, which appear first at the stem and develop in a centrifugal manner to the margin of the pileus. Except for the fact that the gills develop on the exposed under surface of the pileus and not within a gill-cavity, their method of origin is the same as that of the *Psalliota*-type, as opposed to the *Amanita*-type.

**Classification.**—In order to ascertain the genus to which a fungus belongs, it is necessary to know the colour of the spores. This colour is most frequently the same as that of the gills, but not invariably so. Furthermore, the colour of the gills often changes during growth—for instance, those of the common mushroom are first white, then pink, next purple-brown, and, finally, black, while the spores are dark purple-brown. The colour of the spores can easily be ascertained by laying the cap, gills downward, on a piece of paper or glass (see p. 16). Spore-colours, when viewed in mass, can be graded into (1) White, (2) Pink, (3) Ochraceous, cinnamon, or ferruginous, (4) Purple, (5) Black.

In addition to the colour of the spores, it is necessary to note whether a volva or a ring or both are present.

Further, the mode of attachment of the gills must be ascertained. This is best done by making a longitudinal section through the middle of the cap and stem. (This also shows whether the flesh

# Key to Genera of Agaricaceæ.

| | Spores. White. | Pink. | Brown. | Purple. | Black. |
|---|---|---|---|---|---|
| I. Fleshy: not leathery nor woody. | | | | | |
| A. *Ring or volva present.* | | | | | |
| 1. Ring and volva present ... | *Amanita.* | .. | ... | ... | *Annelaria.* |
| 2. Only volva present ... | *Amanitopsis.* | *Volvaria.* | *Acetabularia.* | *Chitonia.* | |
| 3. Only ring present. 4. | | | | | |
| 4. Gills free ... | *Lepiota.* | *Annularia.* | ... | *Psalliota.* | |
| *Gills adnexed or slightly decurrent* ... | *Armillaria.* | ... | *Pholiota.* | *Stropharia.* | |
| B. Neither ring nor volva present. | | | | | |
| 5. Gills waxy ... | *Hygrophorus.* | ... | ... | ... | *Gomphidius.* |
| 6. Gills exuding a milky juice when broken ... | *Lactarius.* | | | | |
| 7. Stem excentric or wanting ... | *Pleurotus.* | *Claudopus.* | *Crepidotus.* | | |
| 8. Stem cartilaginous. 9. | | | | | |
| 9. Gills decurrent ... | *Omphalia.* | *Eccilia.* | *Tubaria.* | | |
| Gills adnate or free ... | *Collybia.* | *Leptonia.* | *Naucoria.* | *Psilocybe.* | *Panæolus.* |
| Gills sinuate ... | *Mycena.* | *Nolanea.* | *Galera.* | *Psathyra.* | *Psathyrella.* |
| 10. Stem fleshy. 11. | | | | | |
| 11. Gills free ... | *Hiatula.* | *Pluteus.* | *Pluteolus.* | *Pilosace.* | |
| Gills sinuate ... | *Tricholoma.* | *Entoloma.* | *Hebeloma.* | *Hypholoma.* | |
| Gills decurrent, fold-like, anastomosing ... | *Cantharellus.* | | | | |
| Gills decurrent, thin ... | *Clitocybe.* | *Clitopilus.* | *Flammula.* | | |
| Gills decurrent, separating from the hymenophore ... | *Paxillus* (*Lepista*). | ... | *Paxillus* (*Tapinia*). | | |

Gills adnate: parasitic on other Agarics ... *Nyctalis.*

Gills adnate; fungus rigid, brittle and usually brightly coloured ... *Russula.*

C. With arachnoid or filamentous veil.

12. Veil forming an arachnoid fugacious ring on the stem ... *Cortinarius.*

13. Veil concrete with the epidermis of the cap ... *Inocybe.*

II. Membranaceous or fleshy membranaceous, fragile, rapidly putrescent or shrivelling up.

14. Gills autodigesting from below upwards ... *Coprinus.*

Autodigestion absent ... *Bolbitius.*

III. Tough, coriaceous, or woody.

15. Stem central. 16.

16. Gills simple: dried plants reviving when moistened ... *Marasmius.*

Gills branched ... *Xerotus.*

17. Stem lateral or absent. 18.

18. Gills anastomosing ... *Lenzites.*

Gills simple, edge entire ... *Panus.*

Gills simple, edge toothed ... *Lentinus.*

Edge of gills split longitudinally ... *Schizophyllum.*

Edge of gills obtuse, crisped ... *Trogia.*

of cap and stem are continuous or not.) The various methods of attachment are shown in Fig. 4. The gills are said to be *free* (A) when they do not touch the stem; *adnexed* (B) when they just reach it; *adnate* (C) when they are slightly attached; *sinuate* (D) when they show a slight curve or *sinus* near the stem; and *decurrent* (E) when they run down the stem.

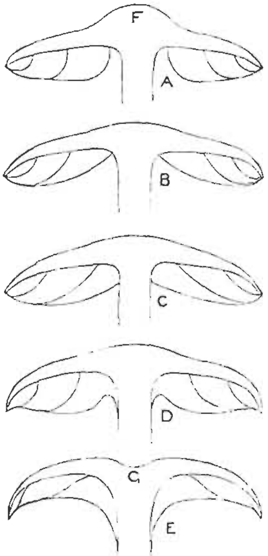


Fig. 4. – Sections of Agarics showing attachment of gills.

The consistency of the fungus, whether leathery, fleshy, &c., is also of generic importance.

The points to observe in specific determinations will best be acquired by reading through a few of the fuller descriptions in the text. In general, they may be said to refer to the shape, colour, size, and surface-character of all parts of the fungus, with, in addition, the habit and the habitat. The various terms used are explained in the glossary.

*Species described.*—The fuller descriptions refer to the species, of which models are shown, or of which there are figures on the stand illustrating "Edible and Poisonous Fungi." The brief descriptions are concerned almost entirely with species which are regarded as being either edible or poisonous. The terms "doubtful" and "suspicious" are employed in certain cases. The former is used for those fungi which are usually avoided, the latter for those which are frequently eaten on the Continent, but which are reputed to have been, at times, the cause of symptoms of poisoning: it is probable that boiling makes the latter quite safe for most people.

### Spores white.

## I. AMANITA Quél.

(Greek *Amanos*, a mountain in Asia Minor which probably abounded in edible fungi, as Galen used the term Amanites for the common mushroom.)

Distinguished by the usually warted cap, white gills free from or just touching the stem, which is bulbous and provided with a median ring and a volva at its base.

Growing on the ground in woods and uncultivated places. There are about twenty British species. *The genus includes the most deadly poisonous fungi known.* A few species are edible.

As the presence of a volva is one of the characteristic features of this genus it is obvious that a wrong diagnosis may eventuate if a fungus be gathered so that the whole of the stem is not dug up. The volva, however, is not always so well-marked as in fig. 2 (*cf.* fig. 5). The variation in persistence and conspicuousness of the volva is due to differences in structure. In certain species the universal veil is membranous and formed of elongated cells which adhere closely to one another: here, after dehiscence, the whole of it remains at the base of the stem except that patches may be left on the cap, never warts. In other cases the universal veil is composed of large rounded cells, which cohere little with one another: in these cases dehiscence takes place in a circumscissile manner towards the base of the stem, leaving warts on the cap and the basal portion as concentric zones of floccose scales. When the universal veil is intermediate in character it splits in a circumscissile manner, leaving warts on the cap and an annular membranous margin at the base of the stem.

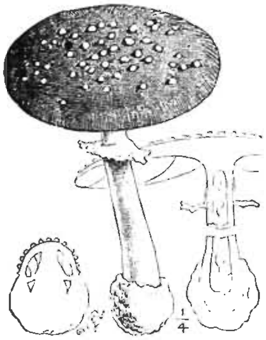

Fig. 5.—*Amanita muscaria*, Pers. (× $\frac{1}{4}$.)

i. Volva membranous, persisting at the base of the stem in the form of a cup; pileus generally naked.

1. **A. phalloides** Secr. (2). (From the volva, like that of *Phallus*.)

Cap whitish, yellowish, yellowish-green, or yellowish-olive, streaked with radiating blackish-bistre fibrils, somewhat campanulate, then expanded, convex, fleshy, clammy, sometimes viscid, satiny when dry, sometimes patched with portions of the white volva; stem whitish often with a tinge of green, bulbous, somewhat attenuated upwards, stuffed, then hollow, smooth or floccose; ring white with a tinge of green or yellow, superior, striate, reflexed; volva white, often greenish or yellowish externally, membranous, thick, half free, spreading, usually more or less buried in the soil; gills white or with a slight greenish tinge, free, ventricose; flesh white, greenish under the cuticle; odour usually slight when young, becoming very strong and fœtid with age.

Woods and adjoining pastures. Very common. April to Nov. $3\frac{1}{2} \times 4\frac{1}{2} \times \frac{5}{8}$. DEADLY POISONOUS.

The ring during development remains for a long time adherent to the margin of the cap. It sometimes dries fairly rapidly and remains on the stem as a dark-coloured pellicle, or may disappear completely in old specimens. In the coloured forms the pileus is darker in the centre on account of the radiating fibrils. The cuticle can be peeled off the cap.

*Poisoning.*—This species is the most dangerous fungus known, being responsible for over 90 per cent. of the deaths caused by fungi: surprisingly small quantities may bring about fatal consequences. An analysis of recorded cases of poisoning by this fungus during the last half-century gives between 50 and 60 per cent. fatalities. Recovery may follow after one to three weeks of intense suffering.

From the extreme danger of this species it is advisable that its distinguishing characters should be learned before gastronomic experiments with unknown fungi are undertaken.

*Symptoms.*—The clinical symptoms are practically always the same, and are characteristic. In cases of fungus poisoning it is essential that the identity of the species eaten should be ascertained as soon as possible. If *A. phalloides* can be ruled out of account the prognosis at once becomes much more favourable. After ingestion there is an incubation period of about 12 hours (8–40), during which little or no discomfort is felt. This is followed by a sudden seizure of intense, increasing, abdominal, cramp-like pains accompanied by violent vomiting and diarrhœa of undigested food with blood and mucus, later becoming cholera-like. Thirst is very characteristic, incessant demands being made for drink, which, however, cannot be retained. If very little fungus has been eaten, the symptoms may begin to abate after two or three days, but recovery is very slow. Usually, however, violent diarrhœa continues with short periods of intermittance. Loss of weight is very great and circulation is feeble: there is cyanosis with chilling of the extremities. The kidneys cease to secrete and muscular cramp occurs, especially in the calves. Usually the victim retains his lucidity. At the end of two days, sometimes a little later, there is an amelioration of symptoms vomiting ceases, colic becomes less frequent, and the patient becomes apathetic and somnolent. This is, however, the most dangerous period. The symptoms soon reappear with intensity, blood is passed, and most frequently the nervous system becomes paralysed by degrees, leading to collapse. In the majority of cases death occurs on the third or fourth day.

If the period be passed jaundice frequently occurs, indicating fatty degeneration of the cells of the liver, a state resembling that brought about by phosphorus poisoning. In those cases where the patient recovers convalescence is very long.

*Treatment.*—It is imperative that competent medical advice should be obtained as soon as possible. It is generally agreed that therapeutic methods are almost useless. There is no antidotal drug for *A. phalloides* toxin, and the treatment is that of poisoning and septic intoxication in general. Several investigators have succeeded in immunising animals to the aqueous extract of *A. phalloides*, but so far the attempt to manufacture a curative serum has not been successful.

*Poison.*—Kobert (1891) established the fact that extracts of *A. phalloides* contain a substance which attacks the red blood-corpuscles of man and of many animals. He gave the name *phallin* to this blood-dissolving hæmolysin, and it was assumed that this substance was the active principle concerned. Ford (1906), however, found that this hæmolysin, an easily decomposed glucoside insoluble in alcohol, is rapidly destroyed by much less heat (140° to 150° F.) than is usually employed in cooking, and that digestive juices, as a rule, break it up. Further, the symptoms of *A. phalloides* poisoning are not those of hæmolysis. Furthermore, the hæmolysin is frequently present only in small quantities, or it may be absent, whereas it is contained in great abundance in *A. solitaria* and *A. rubescens*, both edible species of the same genus. "It is probably a food and certainly harmless" when cooked. In addition to hæmolysin, Ford found that there is also present a heat-resistant body, which reproduces in animals the majority of the lesions described in fatal cases of *A. phalloides* poisoning in man. This "Amanita-toxin," an alcohol-soluble active principle, is the essential poison, resisting the action of heat, of drying, and of the digestive juices.

**A. verna** Pers. (3). (Latin *vernus*, occurring in spring.)

Entirely white. Cap globular, then expanded, and finally a little depressed, viscid, thin, ochraceous in the centre when old, margin finally striate, especially in damp weather, owing to the gills showing through the thin flesh of the cap; stem thin above and progressively bulbous downwards, floccose, stuffed, then hollow; ring superior, entire, membranous, striate, reflexed; volva rather thick, applied to

the stem by the free-lobed margin; gills free, broad, attenuato-rounded; odour not strong, but unpleasant.

Woods, somewhat uncommon. May to Oct. $3 \times 5 \times \frac{3}{8}$. DEADLY POISONOUS.

This is often regarded as a variety of *A. phalloides* and is equally dangerous. The specific name is misleading, as the fungus is more common in autumn than in spring, and *A. phalloides* often appears before it.

**A. virosa** Quél. (1). Differs from 3 in the P. being conical when young; the ring is frequently absent, owing to the partial veil remaining attached to the margin of the P. and becoming torn. Moist woods. O. $5 \times 7\frac{1}{2} \times \frac{3}{8}$.

*Deadly poisonous.* The records of *A. phalloides* poisoning include those of *A. verna* and *A. virosa*.

**A. porphyria** Alb. & Schw. (4 *a*). P. greyish bistre with a purplish tinge; R. white. thin, becoming brownish and draping the stem at some distance from the apex; V. erect, white. becoming brownish. Pine woods. O. $9 \times 3\frac{1}{2} \times \frac{5}{8}$. Very suspicious.

ii. Volva membranous below, friable above, circumscissile or fugacious; pileus generally covered with fragments of the volva.

**A. mappa** *Quél. (4).*—P. *white or yellowish, dry, covered with patch-like* fragments of the circumscissile V.; S. white, base bulbous; R. white, yellowish on exterior; V. yellowish or fuliginous. the upper friable portion disappearing and leaving a short thick margin free from the S. with a groove between them; G. white or yellowish white. Woods. C. $3 \times 3\frac{3}{4} \times \frac{1}{2}$. Poisonous.

**A. recutita** Gill (4 *b*).—P. pale or vinous umber. generally covered with fragments of the V.; S. white. silky, attenuated upwards, base bulbous; V. greyish bistre. sheathing, but short, truncate, extending above the bulb. Pine woods. O. $6 \times 5 \times \frac{5}{8}$. Poisonous.

iii. Volva floccose or friable; pileus floccose or verrucose with the fragments of the volva.

2. **A. muscaria** Pers. (5). (Latin *musca*, a fly from its former use as a fly-poison.) Fly Agaric.

Cap scarlet, blood-red or orange-red, covered with thick white or yellowish warts, the fragments of the volva, globose, then plane, viscid, shining, fleshy, margin finally striate; stem white or tinged yellow, loosely stuffed, then hollow, floccose-scaly or lacerate, apex striate, base bulbous and provided with prominent concentric scales or rings—the remains of the ruptured volva: ring white, sometimes edged with yellow, superior, large, thick, slightly striate; gills white or a little yellowish, free but reaching the stem, crowded, thick, minutely denticulate; flesh white, yellowish under the separable pellicle.

Birch and coniferous woods. July to Dec. Common. $7 \times 10 \times 1$. VERY POISONOUS.

In damp situations the viscosity of the cap sometimes allows the volva to slide off without tearing. The cap is then more or less smooth. and the volva remains at the base of the stem as a cup. There are several varieties.

*Poisoning.*—This species, in spite of its popular reputation, is far less poisonous than *A. phalloides*. Also, the fact that it is bitter and unpleasant in taste and so bright in colour deters older people from sampling it. It is only in those countries where *A. cæsarea* occurs, a fungus famous from classical times for its delicious flavour, that *A. muscaria* is sometimes inadvertently eaten, the former having a bright orange-yellow cap.

*Symptoms.*—The first symptoms appear usually one to four hours after ingestion. Sometimes the illness is not at all serious, consisting of colic, vomiting, and diarrhœa, and recovery is rapid: or it may take the form of excitement and hallucinations, simulating alcoholic intoxication followed fairly rapidly by a deep coma. It is usual, however, for the gastro-intestinal type to be accompanied by delirium, loss of memory, convulsions, or prostration with a tendency to sleep. Recovery is rapid. Apparently the fungus does not cause the death of healthy individuals. The amount of poison apparently varies in different regions and possibly in different years. It appears to be especially localised in the pellicle of the cap.

*Treatment.*—Atropin was formerly used as an antidote to muscarin: this, however, augments the action of mycetoatropin (see below). Emetics and purgatives should be given and chloral or potassium bromide to appease the delirium.

*Poison.*—Schmiedeberg and Koppe (1869) extracted a substance which they called *muscarin* from this fungus, at first regarded as an alkaloid, but probably a complex ammonia derivative. Myceto-muscarin is extremely active and has well-marked effects. These, however, are not those characteristic of *A. muscaria* poisoning. Further, there is very little of it present. An additional fact is that muscarin does not kill flies, whereas the fly agaric has been used for this purpose (broken up in milk) for centuries (*cf.* Valerius Cordus. 1540). At least two other bodies are probably present and their different proportions possibly bring about the difference in symptoms: Myceto-atropin—the effects of atropin on the central nervous system are identical with those produced after ingestion of *A. muscaria*—and choline contained in great abundance, and which (probably with several other related substances and resinoid bodies) is responsible for the gastro-intestinal disturbances.

The use by many Siberian tribes of an extract of the dried cap of *A. muscaria* as a stimulant is well known and was first described by Krasheninnikoff in 1733. The habitual use completely shatters the nervous system, and its sale by traders was made a penal offence by Russian law. As it does not grow on the barren steppes it is a luxury, and Kennan (1870) states that he has seen twenty dollars' worth of furs bought with a single fungus. Fungus intoxication enters into religious ceremonies and apparently is regarded as being sufficient to account for any crime and to ensure immunity from retribution. Considerable degradation attends the rites of certain Korak tribes (Goldsmith, 'Citizen of the World,' Letter 32).

A fresco in a ruined chapel at Plaincouranlt (France), dating from 1291, representing the fall of man, shows the traditional serpent twined round the tree of good and evil offering an apple. The artist has represented the "tree" as a branched *A. muscaria*. Eve has eaten of the tree, judging from her attitude. At this period fungi were only regarded from their good or bad gastronomic qualities.

**A. solitaria** Secr. (9).—P. white to light grey, covered with white, thickish, floccose warts which become greyish and hardened, margin appendiculate; S. white, scaly, with pointed base. Woods. R. $6 \times 5\frac{1}{2} \times 1$. Edible.

**A. strobiliformis** Quél. (8).—P. greyish, covered with large, very thick, grey, angular pyramidal warts; S. whitish, with grey flocci, base bulbous with two or three concentric zones, the remains of the V. Downs. R. $8 \times 6 \times 1\frac{3}{4}$. Edible.

**A. excelsa** Quél. (7). P. grey to brownish with blackish-bistre fibrils, covered with mealy patches of the V., viscid, rugose, margin striate; S. greyish, bulbous, villose, concentrically scaly below the R. Woods. F. $5 \times 5\frac{1}{2} \times \frac{3}{4}$. Poisonous.

3. **A. pantherina** Secr. (6). (Latin *pantherinus*, spotted like a panther.)

Cap brownish grey, fuliginous or greyish olive, sometimes whitish or pale brown, sprinkled with numerous white, fairly persistent warts, fleshy, rounded, then convexo-plane, viscid, shining when dry, margin

striate; stem white, stuffed then hollow, bulbous base surrounded by a membranous concentric volva, sometimes accompanied by a second concentric ring: ring white, distant, thin, striate, oblique, fugacious or more or less obliterated; gills white, just reaching the stem, broader in front: flesh white; taste and smell unpleasant.

Woods, heaths, pastures. Common. July to Oct. $4 \times 5 \times \frac{1}{2}$. VERY POISONOUS.

The effects are similar to, but more severe than, those of *A. muscaria* poisoning (see p. 26). This, or a closely allied species, is used in Japan for killing flies.

**A. cariosa** Gill. (11 *a*).—Differs from 6 in having the P. covered with mealy fragments and in its villose, mealy, subequal S. Woods. R. $5 \times 6 \times \frac{3}{4}$. Poisonous.

**A. spissa** Quél. (11).—P. smoky brown or grey covered with ash-coloured warts, margin often fibrillose; S. white, concentrico-squamulose, short, base obconic, rooting, slightly striate above the R.; odour of radish. Woods. F. $4 \times 4 \times \frac{3}{4}$. Edible.

4. **A. rubescens** Pers. (10). (Latin *rubescens*, becoming red—from the change in colour of the flesh.)

Cap reddish brown or reddish grey, sometimes pale or ochraceous, covered with large, grey, sometimes white or yellowish, mealy warts, fleshy, ovoid then convexo-plane, moist, margin somewhat striate when old; stem pinkish, reddish below, stuffed, then hollow, squamulose, striate at the summit, attenuated upwards, base bulbous; ring white, superior, large, membranous, striate; volva evanescent: gills white, then pink, or spotted with red, decurrent by a tooth, attenuated behind, thin, crowded; flesh white, becoming reddish when broken; taste sweet, becoming acrid.

Woods and heaths. Common. June to Nov. $5\frac{1}{2} \times 5 \times 1$. Edible.

Very variable. The warts often disappear from the cap in wet weather. All parts of the plant become reddish when bruised. The fungus is very frequently attacked by larvæ.

**A. magnifica** Sacc. (14).—Differs from 10 in having a smooth P., an equal S., and a fugacious R. Woods. O. $4 \times 4\frac{1}{2} \times \frac{1}{2}$.

**A. nitida** Secr. (12).—P. white or yellowish, shining, covered with large angular warts, which become brownish; S. white, squamulose below the R., bulbous. Woods. O. $4 \times 4\frac{1}{4} \times \frac{5}{8}$. Poisonous.

**A. aspera** Pers. (13).—P. yellowish to dusky olive, covered with small, pointed, floccose, sulphur-coloured warts; bulbous base of S. and margin of R. bordered with sulphur-coloured flocci. Beech woods. O. $3 \times 3\frac{1}{2} \times \frac{3}{4}$. Poisonous.

**A. arida** Gill. (15) (*Lepiota*).—P. greyish, dry, silky, margin whitish and sulcate; S. white, floccose at the thickened base: R. greyish, distant: G. white, then flesh-colour. Birch and fir woods. O. $3 \times 3\frac{1}{2} \times \frac{3}{4}$. Edible.

Like *Amanitopis vaginata*, but with a ring and no sheathing volva.

**A. lenticularis** W. G. Sm. (17) (*Lepiota*).—P. tan or buff, margin paler and slightly glutinous; S. white, with dark green guttulæ above the R. in wet weather, leaving dingy spots on drying; R. concolorous, frequently spotted like the stem-apex: G. whitish to olivaceous; odour mealy. Woods. F. $4\frac{1}{2} \times 6 \times \frac{3}{4}$. Edible.

(Barlot has recently shown that several of the poisonous species of *Amanita* give characteristic reactions with certain chemical solutions:—

*A. phalloides* treated with sulphuric acid becomes violet, especially in the gills and under the cuticle.

*A. pantherina* treated with potassium hydrate becomes bright orange-yellow, especially the upper portion of the stem and the edge of the gills.

*A. mappa* treated with nitric acid immediately becomes intense blue.

Portions of stem or cuticle of the above species treated with a drop of fresh blood and potassium ferricyanide turn black after a few minutes, though the colour is less intense in *A. mappa*.)

## II. AMANITOPSIS Roze.

Differs from *Amanita* only in the absence of a ring. All British species are edible.

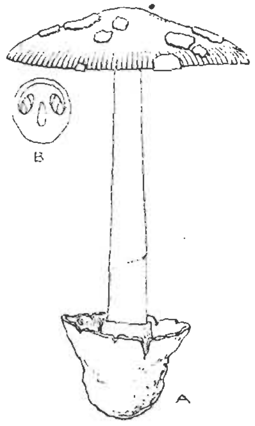


Fig. 6.—*Amanitopsis vaginata* Roze. ($\times \frac{1}{3}$.) A. Mature plant. B. Section of young plant.

**A. vaginata** Roze (18). P. mouse-grey, glabrous, or with white or grey patches of the broken V., margin deeply striate ; V. white or grey, elongated, sheathing, deeply inserted in the ground, often enclosing a ring-like mark round the S. Woods &c. C. $4\frac{1}{2} \times 6\frac{1}{2} \times \frac{5}{8}$. Edible.

**A. fulva** W. G. Sm. (18*a*). Differs from 18 in its tawny P. and yellowish V. Woods, &c. C. $3\frac{1}{4} \times 6\frac{1}{4} \times \frac{3}{8}$. Edible.

**A. nivalis** Rea.—Differs from 18 in being entirely white. Woods &c. O. $3\frac{1}{2} \times 6\frac{1}{4} \times \frac{3}{8}$. Edible.

**A. strangulata** Roze (19). P. chestnut-brown or grey-brown covered with floccose grey scales ; S. greyish ; V. friable, leaving one to three greyish rings round the base of the S. Calcareous woods. F. $6\frac{1}{2} \times 8 \times \frac{1}{2}$. Edible.

**A. adnata** Sacc., 20 (*Amanita junquillea* Quél., 15 *a*).—P. buff-yellow, viscid, clad with greyish patches of the V., margin white and deeply striate ; S. pale buff, fibrillose ; V. adnate, white. There is sometimes a ring present on the stem. Woods. O. $4 \times 5 \times \frac{3}{8}$. Edible.

## III. LEPIOTA Quél.

(Greek *lepis*, a scale, from the scales or squamules on the pileus in many species.)

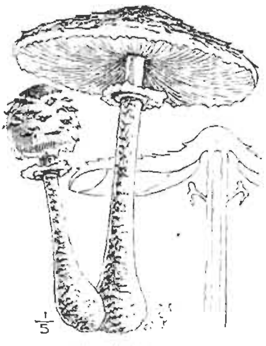


Fig. 7.—*Lepiota procera* Quél. ($\times \frac{1}{5}$.)

In this genus the cap is usually floccose (not warty), the gills are free or remote from the stem and are generally white or whitish ; the stem is hollow as a rule, and is furnished with a ring which does not always persist.

The species grow mostly in grassy places, more often in fields than in woods; some occur in stoves and greenhouses.

*Lepiota* is closely allied to *Amanita*, from which it is chiefly distinguished by the absence of a volva.

The genus contains some of the best-known esculents.

There are about fifty British species.

i. Scales of pileus brown or brownish on a white ground; stem bulbous; ring more or less movable.

5. L. **procera** Quél. (21). (Latin *procerus*, tall.) Parasol Mushroom.

Cap covered at first with a brown cuticle, which breaks up into large shaggy scales more or less regularly disposed on a white surface, the cuticle on the umbo often being continuous, ovoid, then rounded, and finally flattened, margin fimbriate and fibrillose; stem brownish, epidermis finally breaking up into snake-like markings, hollow, bulbous; ring white above, brownish on the exterior, large, becoming free at maturity; gills whitish, quite free, and attached to a collar-like structure which forms a socket for the stem; flesh white; taste and smell pleasant.

Growing in pastures, heaths, orchards, gardens, hedgerows, amongst grass and bracken. July to Oct. Common. $8 \times 11 \times \frac{7}{8}$.

One of the most esteemed of edible fungi, generally preferred to the common mushroom owing to its more delicate flavour. It is said to have been sold in past times in Covent Garden market. The cap, with the scales removed, is delicious when fried in butter. An excellent ketchup can be made from it.

**L. rachodes** Quél. (22).—Differs from 21 in having a flat disc, in its S. being quite smooth, and in the flesh becoming red when broken, particularly in the stem. Woods. C. $5\frac{1}{2} \times 6 \times 1$. Edible.

**L. puellaris** Rea. Differs from 21 in being wholly white and much smaller. Pastures. O. $2\frac{1}{2} \times 3 \times \frac{1}{2}$. Edible.

**L. prominens** Sacc. (22 *a*). Differs from 21 in its strongly and subacutely umbonate brownish or dull pale ochraceous P.; scales imbricate on umbo. Pastures. O. $9 \times 4\frac{1}{2} \times \frac{1}{2}$. Edible.

**L. permixta** Barla (22 *b*). Resembles *L. procera* in the shape and markings of the stem, *L. rachodes* by its flesh becoming reddish, and *L. excoriata* in the sublacerate margin of the P. Hilly pastures. O. $7 \times 4 \times \frac{1}{2}$. Edible.

**L. excoriata** Quél. (23).—P. pale buff, globoso-plane, the cuticle cracking into patches and appearing as if drawn inwards from the fimbriate margin; S. white or greyish, short. Pastures. C. $4 \times 4 \times \frac{3}{8}$. Edible.

**L. gracilenta** Quél. (24).—P. white, with pale brown scales, subumbonate; S. whitish, covered with small yellow scales; R. white, floccose, fugacious. Pastures. C. $4 \times 7 \times \frac{3}{8}$. Edible.

**L. mastoidea** Quél. (25).—More slender than 24. P. whitish, with minute dark brown scales, acutely umbonate; S. whitish or bistre. Pastures. O. $2 \times 3 \times \frac{3}{16}$. Edible.

ii. Pileus and usually the stem scaly or covered with granules; ring fixed.

6. L. **meleagris** Quél. (30). (Latin *meleagris*, guinea-fowl—from the markings.)

Cap brownish flesh-colour, covered with minute almost black scales, fleshy, thin, ovate, then expanded; stem concolorous, tinged yellow in parts, minutely squamulose below the ring, blackish at the base, bulbous, rooting; ring white, often with minute blackish scales on the outside; gills white, then pink, rarely lemon-yellow; flesh bright red when broken. The whole plant turns red when dried.

Hothouses, greenhouses, spent tan. Rare. May to October. $2\frac{1}{4} \times 2\frac{1}{2} \times \frac{3}{16}$. Edible.

The mycelium becomes agglomerated into threads with a differentiated outer layer: borne on this are small, hard, ochraceous sclerotia (*Coccobotrys xylophilus* Boud. & Pat.).

**L. acutesquamosa** Gill. (27).—P. pale ferruginous, covered with small pointed warts, which drop off and leave areolate scars; R. large with rust-coloured warts *on the under side*. Woods &c. F. $4\frac{1}{2} \times 5 \times \frac{3}{4}$.

**L. Badhami** Quél. (28).—All parts of fungus become saffron-red when touched, then blackish. P. pale cinnamon-brown with velvety, dark purple-brown scales; S. concolorous. Hedges, hothouses. O. $4 \times 5 \times \frac{3}{8}$. Suspicious.

**L. hispida** Gill. (32).—P. rusty brown, tomentose, then scaly: S. concolorous, densely floccosely scaly below the R.; smell of radish. Pine and beech woods. R. $3 \times 3 \times \frac{3}{8}$. Suspicious.

**L. clypeolaria** Quél. (33).—P. yellow or brownish, tomentose, then floccose, margin appendiculate with the remains of the veil; S. concolorous. *tomentose* below the floccose, fugacious, concolorous R. Woods. F. $3 \times 4 \times \frac{1}{4}$. Edible.

**L. felina** Karst. (33 *a*).—P. white, covered with concentric, small, blackish scales, disc blackish; S. and R. also white, often sparsely black scaly. Under conifers. F. $1\frac{3}{4} \times 3 \times \frac{3}{16}$. Doubtful.

**L. helveola** Bres.—P. madder-brown, scaly; S. concolorous, fibrilloso-tomentose; R. whitish, fugacious; G. creamy white, edge fimbriate; flesh white, becoming reddish when dry. Pastures. R. $1\frac{1}{2} \times 1\frac{3}{4} \times \frac{3}{8}$. Suspicious.

**L. cristata** Quél. (35). P. whitish, covered with concentric reddish-brown scales, disc brown: S. white to rufescent, silky; R. whitish, often tinged reddish, fugacious; smell strong. Grass. C. $1\frac{1}{2} \times 5\frac{1}{2} \times \frac{3}{16}$. Suspicious.

**L. castanea** Quél.—P. reddish brown, tomentose, then shaggy; S. white, then concolorous, fibrillose: R. white, tawny on outside, fugacious. Woods. O. $1\frac{1}{4} \times 2 \times \frac{3}{8}$. Suspicious.

**L. erminea** Gill. (36).—Entirely white. P. fibrillosely silky towards margin; S. silky: R. at length torn and fugacious: smell and taste of radish. Hilly pastures. O. $2 \times 3 \times \frac{7}{16}$. Doubtful.

iii. Ring superior, fixed, somewhat persistent.

7. **L. cepæstipes** Quél. (41). (Latin *cepa*, onion; *stipes*, stem—from the shape of the stem.)

Cap white or yellowish, mealy, or covered with yellowish, floccose, fugacious scales, umbo darker, membranaceous, obtusely conical then campanulate, margin striate; stem white, delicately and fugaciously flocculose, attenuated upwards, base bulbous; ring white, narrow, membranaceous, becoming free, fugacious; gills white then flesh-colour, at length remote, attenuated at both ends, densely crowded; flesh white, then pink.

Cæspitose. On tan in greenhouses. Fairly common. March to Oct. $2\frac{3}{4} \times 5 \times \frac{3}{8}$. Suspicious.

The species simulates *Coprinus* in habit. It becomes a dirty bluish-green colour when old and deliquesces somewhat. It arises from a small pale or light yellow sclerotium (*Sclerotium mycetospermum* Nees) which develops a delicate flocculose mycelium.

There is a chalky-white variety (*cretacea*) with darker scales.

**L. lutea** Quél. is entirely sulphur-yellow with deeply striate flocculose P. and flocculose S. Coconut-fibre in greenhouses. F. $2 \times 5 \times \frac{1}{4}$. Suspicious.

**L. Vittadinii** Quél. (38).—Wholly white, often becoming greenish. P. densely covered with erect warts; S. floccosely scaly; R. large, flexuose, *often double*; G. thick. Calcareous pastures &c. R. $5\frac{1}{2} \times 7 \times \frac{7}{8}$. Poisonous.

**L. nympharum** Karst. (38 *a*).—Entirely white. P. with white revolute scales, disc ochraceous; apex of S. mealy; flesh becoming reddish under cuticle of P. and at base of S. Grass. O. $4 \times 5 \times \frac{1}{2}$. Edible.

**L. holosericeum** Gill. (39).—Wholly buff-white. P. fibrillosely silky: R. large, membranaceous, pendulous. Gardens &c. F. $4 \times 2\frac{3}{4} \times \frac{5}{8}$. *Edible.*

**L. naucina** Quél. (40) (*Psalliota cretacea*, 790).—Chalky white. P. granular, margin appendiculate with remains of veil: S. fibrillose: R. large, margin fimbriate; G. becoming pinkish: flesh white, usually becoming pinkish when broken. Spore-mass often becoming pinkish. Pastures. F. $5 \times 3\frac{1}{2} \times \frac{5}{8}$. Edible.

iv. Pileus and lower portion of stem covered with granules; ring inferior.

S. **L. granulosa** Quél. (46). (Latin *granulosus*, granular.)

Cap ferruginous or rusty brown, becoming pale hoary when dry, fleshy, convex, then flattened, obtusely umbonate, furfuraceous, granular, often wrinkled, margin appendiculate with the veil; stem white at the apex, minutely brownish squamulose below the concolorous membranaceous torn ring, equal; gills whitish or cream, slightly adnexed, sometimes adnate; flesh yellowish, becoming reddish in the lower portion of the stem; taste pleasant.

Coniferous woods and heaths. Common. July to Nov. $2 \times 2\frac{1}{2} \times \frac{3}{4}$. Edible.

**L. carcharias** Karst. (44). Differs from 46 in its strong smell and bitter taste and in the whitish or ochraceous flesh. P. and S. flesh-colour; G. white, adnate. Coniferous woods. C. $2 \times 1\frac{3}{4} \times \frac{3}{16}$. Suspicious.

**L. cinnabarina** Karst. (45).—Differs from 46 in its cinnabar-colour and larger size; G. white, free. Coniferous woods. R. $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$. Edible.

**L. amianthina** Karst. (47). Differs from 46 in its ochraceous colour and its yellow flesh; G. cream, adnate. Coniferous woods. C. $1\frac{1}{2} \times 2 \times \frac{1}{8}$. Edible.

v. Pileus dry, entire; small, slender.

**L. sistrata** Quél. (49). P. whitish, becoming yellowish or flesh-colour, shining atomate, margin appendiculate with the veil: S. white or flesh-colour, fibrillosely silky and pruinose below the fibrillose fugacious R. Sandy ground. F. $1 \times 2 \times \frac{1}{8}$. Edible.

**L. seminuda** Gill. (50).—Differs from 49 in having the P. covered with fugacious floccose meal: S. mealy below the torn fugacious R. Woods. O. $\frac{5}{8} \times 1\frac{1}{2} \times \frac{1}{16}$. Doubtful.

**L. serena** Sacc. (52 *a*).—P. white, becoming yellowish, silky, margin slightly striate; S. white, becoming greyish, subbulbous: R. white, membranaceous, narrow, erect, fugacious. Grass. O. $1\frac{1}{8} \times 2\frac{1}{2} \times \frac{1}{8}$. Suspicious.

vi. Pileus smooth, viscid.

**L. medullata** Quél. (55). White or grey-white. P. umbonate, margin appendiculate with the veil; S. silky and squamulose below the incomplete torn R., apex striate, stuffed with a removable pith. Coniferous woods. O. $2 \times 3\frac{1}{2} \times \frac{1}{4}$. Doubtful.

**L. delicata** Gill. (57) (*Armillaria*).—P. thin, rufescent, yellowish, pale rose or brownish; S. whitish, tinted as P., floccoso-scaly below the concolorous, membranous, densely floccoso-scaly R.; taste and odour sometimes rank. Hothouses and coniferous woods. R. $1\frac{1}{4} \times 1 \times \frac{1}{8}$. Edible.

**L. illinata** Quél. (58).—P. white or yellowish often with fuscous umbo; S. white, very viscid; R. white, membranous, thin. Plantations. R. $2\frac{1}{4} \times 4 \times \frac{5}{16}$. Edible.

**L. irrorata** Quél. P. yellowish. S. white, satiny above membranous R., yellow or brownish squamulose below; G. white to cream; P. and S. apex covered with dew-like drops. Pastures. $1\frac{3}{4} \times 1\frac{1}{2} \times \frac{1}{3}$. Doubtful.

## IV. HIATULA Mont.

A small genus, which differs from *Lepiota* in the absence of a ring in the adult stage. All species are very rare.

**H. lycoperdoides** W. G. Sm. (60 *a*) $1\frac{1}{2}\times1\frac{1}{2}\times\frac{1}{3}$ and **H. grangei** W. G. Sm. (60 *c*) $1\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{8}$ do not have a ring: growing on the ground (*Schulzeria* Bres.).

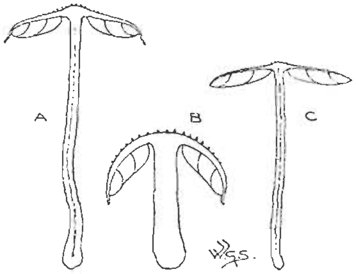


Fig. 8.—Section through A. *Hiatula Eyrei* W. G. Sm.; B. *H. lycoperdoides*, W. G. Sm.; C. *H. grangei* W. G. Sm. ($\times\frac{1}{2}$.)

**H. Wynneæ** B. & Br. (60 *b*) has a very fugacious R.; growing on wood in stoves. Luminous with a greenish light. $1\frac{1}{2}\times2\times\frac{1}{16}$.

**H. Eyrei** W. G. Sm. (60) has bluish-green spores; growing on the ground (*Glaucospora* Rea). $1\frac{1}{2}\times3\times\frac{1}{8}$.

## V. ARMILLARIA Quél.

(Latin *armilla*, a bracelet.)

*Armillaria* is distinguished from *Amanita* in having no volva, and from *Lepiota* by having the gills adherent or slightly decurrent; the flesh of the cap and stem is homogeneous. The cap is smooth, scurfy, or sometimes slightly scaly, but does not show the large patches so common in *Lepiota* nor the warts of *Amanita*. No species of *Armillaria* is known to be poisonous. There are about fifteen British species.

9. **A. mellea** Quél. (69). (Latin *mel*, honey from the honey-coloured cap.)

Cap livid, yellowish, tawny, or sooty-brown, with a somewhat greenish tint, sometimes dark grey or pinkish, convex with thin inflexed margin, then expanded, often downy and scurfy, or flecked with dark-coloured specks or scales which are more distinct at the centre, margin striate; stem concolorous with the cap or paler, becoming blackish with age, externally rigid, spongy within, equal or slightly swollen at the base, apex striate; ring white with a sulphur-yellow border, usually large and persistent, sometimes small, reduced to a few arachnoid threads or absent; gills whitish, sometimes spotted brown, then rufescent, usually decurrent, sometimes adnate; flesh yellowish or brownish; smell foxy; taste acrid.

Fig. 9.—*Armillaria mellea* Quél. ($\times\frac{1}{3}$.)

Very common on or near decayed stumps. July to Dec. $4\frac{1}{2} \times 5 \times \frac{5}{8}$. Edible.

This species is remarkably polymorphic; about a dozen forms have been given definite names.

The fungus produces a vast number of spores, which are often sufficiently abundant to whiten the stump on which it grows or the leaves of the surrounding herbage. On a sunny day the spores can be seen given off in clouds.

*A. mellea* is one of the most dangerous tree-parasites known. The spores germinate freely on dead stumps; the mycelium spreads through the stumps, and gives rise to a fresh crop of sporophores. The mycelium also sends off underground rhizomorphs, which look like black leather bootlaces. These rhizomorphs spread through the soil for considerable distances. They are formed of compacted masses of hyphæ (cf. *sclerotia*, p. 6), and at the apical growing-point consist of three fairly distinct layers, an outer loose weft of thin hyphæ sending out aerial branches, a middle cortex of longitudinal closely-packed hyphæ, and a medulla of much broader hyphæ; as the rhizomorph ages various changes take place—in the mature rhizomorph the outer rind is formed by the cortex, of which the cell-walls have become black, hardened, and thickened, the primary medulla restricted to a few layers of hyphæ lining the inner side of the cortex, and the resulting cavity filled by a secondary medulla. Branches arise through a new growing-apex being formed in the inner layers of the cortex. When the underground rhizomorph comes in contact with the roots of living trees, under circumstances favourable for infection, they force their way in. On reaching the inner layers of the bark the apex flattens out and forms a white felt-like mycelium, which usually spreads in the region occupied by the cambium, and attacks the xylem and phloem principally by way of the medullary rays, bringing about the death of the tree. Later the wood is penetrated and slowly decays, the earlier stages of rot being characterised by the formation of a thin layer, which appears as an irregular "black line" when the wood is cut across. The line is entirely made up of fungal hyphæ. As long as there is sufficient moisture the fungus continues to grow: when the bark contracts away from the wood the fungus takes the form of a reticulated mass of flattened blackish rhizomorphs. The connection between the underground rhizomorph, the rhizomorph under the bark, and the mature sporophore was unsuspected by earlier workers, who regarded them as three different species—*Rhizomorpha subterranea*, *R. subcorticalis*, and *Agaricus melleus*.

The rhizomorphs are also able to attack and destroy potatoes.

The mycelium of the young rhizomorph is luminous (see p. 8).

*Mycorrhiza.*—An unlooked-for property of the rhizomorph of *A. mellea* is that of being able to form the mycorrhiza of an orchid. The saprophytic Japanese orchid, *Gastrodia elata*, has, as its vegetative structure, merely a tuberous rhizome about five inches long. This, unless infected, gives rise to offsets which each year repeat the process, the offsets becoming progressively smaller until, finally, they are incapable of growth. If, however, a rhizomorph encounters the mother tuber it attacks it in a manner recalling that in which dodder fastens on to ling or clover, and the strand sends its hyphæ into the cells of the tuber. A complicated union is formed, the orchid being able to hold the fungus in check and make use of the food brought it instead of succumbing and giving up its reserve food-material as in the potato. The direct result of this is that the offset given off by the infected mother tuber is fully grown and develops an inflorescence axis the following year. Without the co-operation of the rhizomorph no flowers are produced.

*Endomyces decipiens* Reess (Saccharomycetales) grows between the old gills of *A. mellea*.

**A. mucida** Quél. (72) is wholly white or whitish. P. shining, radiately wrinkled, middle sometimes faintly brownish, glutinous; S. externally cartilaginous. Parasitic on beeches. C. $3\frac{1}{2} \times 6 \times \frac{1}{4}$. Edible.

**A. bulbiger** Quél. (61).—P. pale orange or brownish, margin paler and often floccose from remains of the veil; S. whitish, scaly up to the R. and sometimes longitudinally black fibrillose, base strongly bulbous; R. arachnoid. Like a white-spored *Cortinarius* in appearance. Pine woods. O. $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$. Edible.

**A. focalis** Sacc. (62).—P. reddish tawny, silky fibrillose; S. whitish, becoming tawny, fibrillose: R. oblique; flesh pale tawny. Pine woods. R. $4\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{4}$. Edible.

**A. robusta** Gill. (63).—P. rich brown, very fleshy, margin paler and silky fibrillose; S. white, rufescent squamulose below the R., apex mealy, short, fusiform; R. white, striated with rufescent fibrils, large. Coniferous woods. C. $2\frac{1}{2} \times 2 \times \frac{3}{4}$. Ediblo.

**A. caligata** Gill. (63*a*).—P. tawny weasel colour, spotted with darker, adpressed, silky squamules, *margin* white *and* appendiculate with the veil; S. white and mealy at the apex, zoned with brown squamules below the R.; odour fruity. Pine woods. O. $4 \times 3\frac{1}{2} \times 1\frac{1}{8}$. Edible.

**A. constricta** Gill. (68).—Wholly white, becoming ochraceous when bruised. P. *pruinose, then silky*; S. *slightly rooting, fibrillose, or squamulose*; R. *apical*, narrow. In pastures where scorched with urine. O. $2 \times 1\frac{1}{4} \times \frac{3}{8}$. Edible.

**A. ramentacea** Quél. (65).—Like *Tricholoma terreum* (No. 12) in appearance, but having a membranaceous ring and scaly stem; G. and R. commonly becoming stained yellow. Under pines. O. $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$. Edible.

**A. hæmatites** Sacc. (66).—P. red liver-colour, slightly hispid, becoming smooth: S. concolorous below the R., whitish above, base white, floccose; R. inferior, torn, often fugacious; G. white, then pinkish; flesh pale liver-colour, darker at base of S. Amongst fir-leaves. R. $1\frac{1}{2} \times 1\frac{3}{4} \times \frac{1}{8}$. Edible.

## VI. **TRICHOLOMA** Quél.

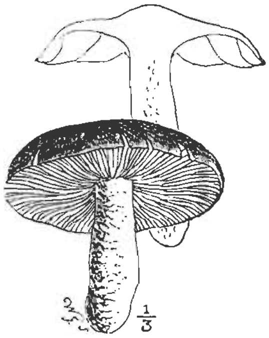


Fig. 10.—*Tricholoma saponaceum* Quél. (× $\frac{1}{3}$.)

(Greek *thrix*, a hair, *loma*, a fringe—from the hairs or filaments on the margin of the cap in certain species.)

The chief feature in this genus is the sinuate character of the gills, though this is not always shown in young specimens. The cap is usually convex and fleshy, never umbilicate; the stem is fleshy.

Almost without exception growing on the ground. There are about a hundred British species. The genus contains a large number of edible species; a few forms are suspicious.

i. Pileus with a gelatinous viscid pellicle, not hygrophanous.

10. **T. sejunctum** Quél. (74). (Latin *sejunctum*, separated—from the gills being separated from the stem.)

Cap buff or yellow streaked with innate blackish fibrils, convex, then expanded, viscid in wet weather; stem white, clouded pale yellow, ventricose, then elongated, apex delicately squamulose; gills shining white, broad, somewhat distant; odour of meal, taste somewhat bitter.

Woods, chiefly pine. Common. Sept. to Nov. $4 \times 4\frac{1}{2} \times 1$. Edible.

**T. equestre** Quél. (73).—Entirely sulphur-olive. Differs from 74 in lacking the radiating blackish streaks on the P., and in the yellow G.; taste pleasant. Pine woods. F. $4 \times 3 \times 1$. Edible.

**T. portentosum** Quél. (75). P. slaty brown often with a purple tinge, black fibrillose; S. white, tinged yellow or greenish, fibrillosely striate; G. white, then yellow or glaucous. Coniferous woods. F. $4\frac{1}{2} \times 3\frac{1}{2} \times 1$. Edible.

**T. fucatum** Gill. (76).—Differs from 75 in the P. being glabrous and not innately black fibrillose, but stained lurid yellowish or greyish yellow variegated with bistre spots, disc darker. Pine woods. O. $3\frac{1}{4} \times 3\frac{3}{4} \times \frac{3}{4}$. Doubtful.

**T. resplendens** Karst. (78). Wholly shining white, becoming yellowish externally and internally; margin of P. straight; S. somewhat bulbous. Under hazels etc. F. $2\frac{3}{4} \times 2\frac{1}{2} \times \frac{1}{2}$. Edible.

**T. colossum** *Quél.* (80) (*Armillaria*).—Resembling *Boletus edulis* (No. 123) in colour and size. P. reddish tawny, very obtuse, margin whitish and incurved; S. concolorous below the very fugacious R. Pine woods. R. $8 \times 4\frac{1}{2} \times 1\frac{3}{4}$. Edible.

**T. flavobrunneum** Quél. (83).—P. tawny or rich brown, disc darker, streaked; S. rufescent, fibrillose, viscid at first, attenuated at both ends; flesh sulphur-yellow in S.; smell of meal. Woods. C. $3\frac{1}{2} \times 2\frac{1}{4} \times \frac{3}{4}$. Edible.

**T. albobrunneum** Quél. (84).—Differs from 83 in its S. being constantly white at both ends, in its white G. and flesh, and absence of odour. Coniferous woods. C. $4 \times 2 \times \frac{3}{4}$. Edible.

**T. ustale** Quél. (85).—Differs from 84 in having a smooth P.; S. rufescent; flesh white, sometimes becoming pink. Coniferous woods. F. $2 \times 2 \times \frac{3}{8}$.

**T. pessundatum** Quél. (86). Differs from 85 in its guttate spotted or granulate P., its white S. with brownish granules, and its mealy taste and smell. Fir woods etc. O. $4 \times 2\frac{1}{2} \times 1$. Edible.

**T. Russula** Gill. (88) (*Hygrophorus*).—P. pale pink to rosy red, somewhat variegated; S. white, becoming reddish with age, apex white flocculose; G. white, thick. Woods. O. $5 \times 2\frac{1}{2} \times 1$. Edible.

ii. Pileus never viscid; pellicle torn into fibrillose or floccose scales.

11. **T. rutilans** Quél. (90). (Latin *rutilans*, becoming reddish.) Cap at first covered with a purplish-red tomentum, soon variegated with purple and ferruginous brown on a yellow ground, campanulato-expanded, dry; stem light yellow variegated with purple squamulose flocci, somewhat ventricose; gills sulphur-yellow, sinuato-adnate, crowded, broad, with thickish floccose edge; flesh yellow.

Pine woods, on or near stumps. Common. Aug. to Nov. $5\frac{1}{2} \times 4 \times 1$. Edible, but of little value. Disagreeable when cooking.

**T. variegatum** Gill. (91).—Differs from 90 in being smaller and in having the G. edge naked. Rotten wood. O. $2\frac{1}{2} \times 3 \times \frac{3}{8}$.

**T. luridum** Quél. (92).—P. yellowish grey, disc darker, irregular, fibrillosely *rimose, margin fimbriate*; G. whitish to *greyish, very crowded; flesh white*; smell of meal. Pine woods. F. $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$. Edible.

**T. columbetta** Quél. (94).—Wholly shining white, occasionally spotted pink or blue. P. dry, then silky fibrillose, margin incurved and tomentose; base of S. often bluish green or violet. (It is probable that the brightly coloured stains are due to the attacks of a parasitic *Hypomyces*.) Woods etc. F. $4 \times 3 \times \frac{3}{4}$. Edible.

**T. imbricatum** Quél. (96).—P. rufous umber, very scaly, margin involute and pubescent; S. brownish, ventricose, adpressedly scaly, apex mealy; G. white. Coniferous woods. F. $4\frac{1}{2} \times 2\frac{3}{4} \times \frac{3}{4}$. Edible.

**T. vaccinum** Quél. (97).—Differs from 96 in having a woolly margin to its P., a corticate S. without mealy apex, and in its flesh becoming reddish. Coniferous woods. C. $2\frac{3}{4} \times 2\frac{1}{2} \times \frac{3}{8}$. Edible.

12. **T. terreum** Quél. (101). (Latin *terreus*, earthen—from the colour.)

Cap mouse-grey, fuscous, bistre, or blackish, umbonate, campanulato-repand, villose, innately fibrillose to fibrilloso-floccose, inclining to split, very brittle; stem white or grey, equal, floccosely fibrillose, apex white pruinose; gills white, then cinereous, emarginate, subdistant, edge uneven; flesh whitish grey; taste slightly acrid.

Woods chiefly beech and pine, all the year round; very common. $3\frac{1}{4} \times 2\frac{3}{8} \times \frac{5}{8}$. Edible.

Grouped round *T. terreum* there are a number of forms which are sometimes regarded as varieties, sometimes as distinct species.

**T. gausapatum** Quél. (100).—Differs from 101 in the dark densely felted P. with paler margin, and in the narrow G. Woods etc. R. $3 \times 2 \times \frac{3}{4}$. Edible.

**T. scalpturatum** Quél. (95).—Differs from 101 in having yellowish G. Fir woods. O. $3 \times 3 \times \frac{3}{4}$. Edible.

iii. Pellicle of pileus rigid punctato-granulate, or cracking into small squamules when dry.

13. **T. murinaceum** Gill. (111). (Latin *mus*, mouse—from the colour.)

Cap lilac-grey or mouse-grey with innate silky fibrils, fibrilloso-scaly on the disc, scales sometimes blackish, brittle; stem concolorous, more or less scaly like the cap, twisted; gills white, then grey, broad, distant; taste very bitter; odour disagreeable, sometimes nitrous. The whole plant becomes cinereous.

Mixed woods, not uncommon. Sept. to Nov. $4 \times 3\frac{1}{2} \times \frac{3}{4}$. Doubtful.

**T. hordeum** Quél. (111 *a*).—P. grey, disc darker, soon cracking and covered with minute, squarrose scales; S. whitish, shaded greyish, glabrous, striate; taste mild. Beech woods. O. $5\frac{1}{2} \times 4\frac{1}{2} \times \frac{3}{4}$. Doubtful.

**T. saponaceum** Quél. (103).—P. livid or olive brown, smooth, then cracked and scaly; S. pale yellowish grey, often becoming reddish; G. whitish with greenish tinge; flesh white, becoming reddish; smell soapy. Woods. C. $2\frac{1}{2} \times 2\frac{3}{4} \times \frac{3}{4}$. Suspicious.

**T. atrocinereum** Quél. (107). P. grey, disc prominent and darker; S. whitish, striate, apex naked; odour of meal. Amongst grass. O. $1\frac{3}{4} \times 1\frac{3}{4} \times \frac{1}{4}$. Edible.

**T. cuneifolium** Gill. (108). P. deep brown to livid, pruinose, often concentrically cracked; S. pale brownish, white above, attenuated downwards, hollow, splitting; G. greyish, ovate wedge-shaped, often connected by veins; odour of meal. Amongst grass. C. $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{3}{8}$. Edible.

**T. crassifolium** Sacc. (109). P. ochraceous or somewhat buff, disc umber; S. white, becoming fuscous, pruinose, attenuated at the base; G. greyish to bluish, becoming black when touched, distant, thick; flesh white spotted black; smell rancid. Fir woods. O. $2\frac{1}{2} \times 1\frac{3}{4} \times \frac{3}{4}$. Suspicious.

**T. sudum** Quél. (109 *a*).—P. ashy rufous or brownish, often rimosely squamulose, margin paler; S. rufous, punctate with minute squamules, fibrillosely striate, apex dilated, base white floccose; G. whitish, edge rufescent. Amongst grass. R. $3\frac{3}{4} \times 3\frac{1}{2} \times \frac{3}{8}$. Suspicious.

**T. tumidum** Gill. (110).—P. livid grey, spotted, bullate, irregular, often cracked, shining when dry; S. shining white, striate, sometimes swollen, base often attenuated and rooting; G. shining white, then cinereous rufescent. Pine woods. O. $3\frac{1}{4} \times 3\frac{3}{4} \times \frac{5}{8}$. Edible.

iv. Pileus slightly silky at first, becoming smooth, very dry.

14. **T. sulphureum** Quél. (113). (Latin *sulphureus*, like sulphur.)

Cap sulphur-yellow, often with rufescent disc, globose to convexo-

expanded, subumbonate, then depressed, silky, becoming smooth; stem concolorous, equal, often curved, fibrous, striate; gills sulphur-yellow, adnexed, somewhat thick, and distant; flesh yellow; odour strong and penetrating of gas-tar.

Oak and mixed woods. Common. Aug. to Nov. $3\frac{1}{2} \times 4 \times \frac{1}{2}$. Suspicious.

**T. bufonium** Gill. (114).—Differs from 113 in its umber, fuscous tan, or tawny, rugulose P. and its yellow or yellow rufescent floccluose S.: G. yellow-tan; smell similar, but weaker. Pine woods. O. $3 \times 2\frac{3}{4} \times \frac{1}{2}$. Doubtful.

**T. lascivum** Gill. (115).—P. cream to pale buff, obtuse disc darker, margin at first involute; S. whitish, fibrillose, apex white pruinose, base tomentose; G. whitish, thin, crowded; odour of gas-tar. Deciduous woods. F. $3 \times 2\frac{3}{4} \times \frac{1}{2}$. Doubtful.

**T. inamœnum** Gill. (116).—P. dirty white, subumbonate; S. white pruinose, villose; G. shining white, rather thick, distant; odour of gas-tar. Pine woods. O. $2\frac{1}{4} \times 3\frac{1}{2} \times \frac{3}{8}$. Doubtful.

**T. cerinum** Quél. (117).—P. yellow, then fuscous brown; S. yellow, base often brownish; G. deep yellow. Pine woods. R. $1\frac{1}{4} \times 2 \times \frac{1}{4}$. Edible.

**T. ionides** Quél. (119).—P. lilac or violaceous; S. concolorous, fibrillosely striate; G. white, becoming yellowish. Much like *Mycena pura* in general appearance. Woods etc. O. $2\frac{1}{4} \times 2 \times \frac{1}{4}$. Edible.

**T. carneum** Quél. (120).—P. reddish flesh-colour, thin; S. paler than P., tough, attenuated downwards, apex pruinose; G. white, very crowded. Pastures etc. C. $1\frac{3}{4} \times 1\frac{1}{2} \times \frac{1}{4}$. Edible.

v. Pileus fleshy, soft, fragile, spotted or rivulose. Vernal.

15. **T. gambosum** Gill. (122). (Latin *gambosus*, having a swelling on the hoof—from the shape of the cap.)

Cap ochraceous or pale tan, very fleshy, hemispherical to convex, undulated, repand, spotted, at length widely cracked, margin at first involute and tomentose; stem ochraceous, thick, solid, firm, and fleshy, subequal, with a white villous apex striate from the decurrent teeth of the gills; gills whitish, rounded, ventricose, crowded, emarginato-adnexed; flesh white; smell and taste strong of new meal.

Pastures. Not uncommon. April to July. $3\frac{1}{4} \times 2 \times 1$.

A well-known esculent, which with the following closely allied species is known as St. George's Mushroom, from its being often seen on St. George's Day, 23rd April. Without careful cooking it has a tendency to toughness. The fungus should be gathered in dry weather.

**T. Georgii** Quél.—Differs from 122 in its slightly floccose P. with naked margin. Woods etc. F. $2\frac{1}{2} \times 1 \times \frac{3}{4}$. Edible.

16. **T. albellum** Quél. (123). (Latin *albus*, white.)

Cap yellowish, then whitish, becoming grey when dry, fleshy, conical, then convex, gibbous when expanded, moist, spotted, margin thin and naked; stem concolorous, fibrillosely striate, thick, solid, and somewhat bulbous; gills white, then cream-colour, attenuato-adnexed, broad in front, very crowded; flesh white; smell and taste weak of new meal.

Woods. April to Oct. O. $3 \times 2 \times 1$. (Smaller when connate.) The model exhibits an abnormal form.

**T. amethystinum** Gill. (125).—P. violet grey or purple; S. violet, striate; G. white, then rufescent; smell of meal; flesh white. Pine woods. R. $2\frac{1}{2} \times 2 \times \frac{1}{2}$. Edible.

**T. tigrinum** Quél. (126).—P. pallid brown to violet grey, with darker crowded spots, margin white and involute; S. white, pruinose, thick, solid; G. white, crowded, narrow. Fir woods. O. $2 \times 1\frac{1}{4} \times 1$. Poisonous.

**T. pes-capræ** Quél. (127).—P. grey to fuscous, variegated, rimosely incised; S. white, naked; G. white to cinereous; smell of meal. Under oaks. R. $2 \times 2\frac{3}{4} \times 1$. Edible.

vi. Pileus compact, then spongy, obtuse, even, smooth, moist, but not hygrophanous.

**T. personatum** Quél. (138). (Latin *personatus*, masked—in reference to the margin of the cap as compared with *T. nudum*, 139.)

Cap greyish to brownish, tinged lilac, lavender, or purple, often sordid white when old, very fleshy, thick, hemispherical to convex and flattened, even, smooth, moist in wet weather, opaque when dry, margin involute and white pruinose at first; stem whitish, covered with evanescent blue fibrils, thick, rather short, equal, base often bulbous; gills whitish, becoming livid or purplish, rounded, then free, broad, crowded; flesh greyish when moist, white when fresh.

Pastures and downs, often forming large rings. C. $5 \times 3 \times 1$.

Known by the popular names "blue-leg," "blewitt," "bluette." Excellent when gathered in dry weather. Formerly sold in Covent Garden Market.

This species and several of its allies (*T. sævum*, *T. nudum*, *T. sordidum*) have pink verrucose spores, and the gills separate easily from the cap. Maire includes them in a genus *Rhodopaxillus*.

**T. acerbum** Quél. (135). P. yellowish buff or brown, moist, margin strongly involute, viscid, and tomentosely ribbed over the edge of the G.; S. white, becoming yellowish, apex white mealy; G. pallid, then rufescent. Woods etc. F. $6 \times 3 \times 1$. Edible.

**T. glaucocanum** Bres. (138 *a*).—P. bluish grey, margin incurved and floccoso-pruinose; S. whitish grey, bulbous, fibrilloso-striate, apex subsquamulose; G. purple-greyish, emarginate, very crowded. Calcareous woods. F. $3 \times 3 \times \frac{3}{4}$. Edible.

**T. sævum** Gill. (138 *b*).—Differs from 138 chiefly in its shorter shaggy-squamulose S. and its pallid whitish or reddish G. Woods etc. O. $3\frac{1}{2} \times 2\frac{1}{4} \times 1$.

**T. nudum** Quél. (139).—Differs from 138 in being wholly purple, the P. and G. becoming rufescent; edge of P. naked; flesh lilac when young. Woods etc. C. $3 \times 3 \times \frac{1}{2}$. Edible.

**T. cinerascens** Gill. (140).—P. white to ashy grey; S. whitish; G. greyish white, then darker; odour disagreeable; becoming blackish on bruising. Woods. F. $3 \times 3\frac{1}{4} \times \frac{1}{2}$. Edible.

**T. panæolum** Quél. (141).—P. sooty grey or brownish, pruinose, often spotted, margin white mealy and involute; S. whitish grey, fibrillosely striate; G. greyish or white, often with rufous tinge. Pastures. C. $3\frac{1}{4} \times 2 \times \frac{1}{2}$. Edible.

**T. cnista** Gill. (141 *a*).—Differs from 141 in having a pale tan or whitish P.; G. white, pallid yellow or reddish when bruised. Pastures. R. $4 \times 3 \times \frac{1}{2}$. Edible.

**T. oreinum** Gill. (132). P. brownish grey, margin incurved and exceeding the white, almost free G.; S. white, fibrillosely striate, apex mealy, base bulbous. Heaths etc. F. $1\frac{1}{2} \times 1 \times \frac{1}{4}$. Edible.

**T. album** Quél. (133).—Entirely white. P. sometimes yellowish at the disc, margin at first incurved and floccosely striate over the G.; S. attenuate upwards, elastic; G. emarginate, somewhat crowded; smell pleasant, taste bitter. Mixed woods. F. $4\frac{1}{2} \times 4 \times 1$. Suspicious.

**T. leucocephalum** Quél. (134).—Differs from 133 in having a villosely silky P., the S. rooting at the attenuated base, and a mealy smell. Woods. O. $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{4}$. Edible.

vii. Pileus thin, subumbonate, hygrophanous, changing colour on drying.

**T. grammopodium** Quél. (143).—P. brownish, whitish when dry; S. white, longitudinally striate with brownish fibrils, subbulbous, white villose below; G. white, then bistre, very crowded. Pastures etc. F. 5×4×¾. Edible.

**T. melaleucum** Quél. (144).—P. smoky brown when moist, ochraceous tan when dry, umbo darker; S. streaked with smoky fibrils, base fuscous; G. white. Woods etc. C. 3¾×2½×½. Edible.

**T. brevipes** Quél. (145).—P. pale or red brown; S. brown, short, bulbous, fibrillose, apex pruinose; G. fuscous, becoming white; flesh brown. Woods etc. O. 3¾×1¼×½. Edible.

**T. humile** Quél. (146).—Differs from 145 in its longer villosely pulverulent S., in its frequently cæspitose habit, and its mealy odour. Woods etc. 2¼×1¾×¼. Edible.

**T. excissum** Quél. (147).—P. brownish grey varying dark brown, umbonate; S. white, then ochraceous, smooth; G. white, narrow, edge uneven. Pastures. O. 3×2½×⅜. Edible.

**T. subpulverulentum** Karst. (148).—P. pale livid brown, becoming greyish to whitish, pruinose, margin narrow and exceeding the G.; S. white, substriate; G. white, becoming darker. Woods etc. O. 2×1½×⅜. Edible.

**T. sordidum** Quél. (149).—Can be distinguished from a pale form of *T. nudum* (139) in being smaller, tougher, and hygrophanous; P. pale livid tan to purplish brown. Pastures. C. 3×2½×⅜. Edible.

## VII. CLITOCYBE Quél.

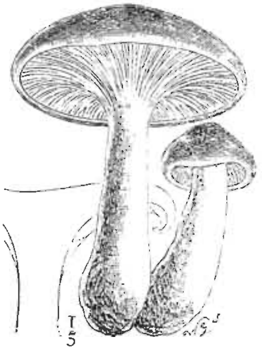

Fig. 11.—*Clitocybe nebularis* Quél. (×½.)

(Greek *klitos*, a declivity, *kube*, a head—from the decurrent gills.)

The cap is usually fleshy, plane, depressed, or infundibuliform with the margin involute; the gills are generally and typically decurrent, sometimes acutely adnate, but never sinuate; the stem is fibrous externally, elastic, spongy-stuffed, often becoming hollow, never cartilaginous.

Growing on the ground, rarely on wood. Few, if any, species are poisonous. There are about eighty British species.

i. Pileus fleshy, often becoming pale and silky when dry, not hygrophanous.

*a*. Pileus convex, then plane or depressed, regular, obtuse.

**C. nebularis** Quél. (153). (Latin *nebula*, a cloud—from the pruinose cap.)

Cap smoky-brown, grey, or pale slate, very fleshy at the disc, thinner towards the margin, convex, then plane, obtuse, dry, grey pruinose at first, becoming smooth; stem whitish or greyish, fibrillosely striate, spongy-elastic, thickened at the base, attenuate upwards; gills whitish, sometimes becoming yellow, shortly decurrent, arcuate, very crowded, thin; flesh white; taste somewhat peppery, smell pleasant.

Woods, heaths, pastures. Common. Aug. to Dec. $6 \times 4\frac{1}{2} \times 1\frac{1}{4}$. A well-known esculent.

The white mycelium, not infrequent on the cap, gives rise to *Volvaria Loveiana* Gill. (451).

**C. clavipes** Quél. (154).—Differs from 153 in the almost obconical P., the bulbous base to the grey or bistre conical S., and the deeply decurrent G. Woods. C. $3 \times 2\frac{1}{2} \times \frac{1}{2}$. Suspicious.

**C. polia** Karst. (155 *a*).—P. grey, convexo-plane, smooth, with white incurved margin: S. greyish white, base subbulbous. G. white, very crowded, and very narrow. Cæspitose, usually in small clusters. Woods. R. $2 \times 3 \times \frac{3}{4}$. Edible.

17. **C. inornata** Gill. (156). (Latin *inornatus*, unadorned.)

Cap livid, plane or depressed, obtuse, even, smooth, with a separable pellicle which frequently cracks from the margin and peels up; stem greyish or brownish, solid, somewhat equal, smooth, firm: gills concolorous with the stem, adnate, plane, at length decurrent, crowded; flesh grey; odour mushroom-like. A somewhat doubtful species. Under cedars. Very rare. Oct. to Nov. $4 \times 2 \times \frac{1}{2}$. Suspicious.

**C. luscina** Karst. (156 *a*).—P. brown, then grey; S. greyish white, pulverulent, attenuate downwards: G. sordid, then whitish, horizontal, straight, crowded. Pastures. R. $2 \times 2 \times \frac{3}{16}$. Edible.

**C. hirneola** Quél. (158).—P. almost grey-white, minutely silky-hoary, plano-depressed, umbilicate, somewhat viscid when fresh: S. concolorous, elastic, apex white pruinose; G. paler, subdecurrent, crowded. Amongst grass and leaves. O. $1\frac{1}{2} \times 1\frac{3}{8} \times \frac{1}{8}$. Edible.

**C. opipara** Gill. (161).—P. bronzy flesh-colour, shining, at first with scattered fibrils; S. whitish; G. whitish, adnato-decurrent, crowded; taste mealy. Mossy places under trees. O. $3 \times 3 \times 1$. Edible.

**C. vernicosa** Gill. (165).—P. pale yellowish, shining, regular, scarcely depressed, margin involute; S. yellow; G. sulphur-yellow, adnato-decurrent, subdistant. Fir and larch woods. R. $3 \times 2 \times \frac{3}{4}$. Edible.

18. **C. odora** Quél. (168). (Latin *odorus*, fragrant.)

Cap greenish, fleshy, convex, then flattened, obtuse or slightly umbonate, then depressed, smooth and moist in wet weather, margin incurved and pubescent; stem concolorous, stuffed, flexuous, often short and slightly bulbous, at first floccoso-fibrillose, then smooth, usually white, villous at the base; gills somewhat duller and paler than the cap, adnato-decurrent, slightly distant; taste pleasant; smell strong of anise.

Sometimes somewhat cæspitose. Deciduous woods. Common. Aug. to Nov. $3 \times 1\frac{1}{2} \times \frac{3}{8}$. Edible.

**C. viridis** Gill.—Differs from 168 in the pale greenish-blue P. with naked margin and in the white, tinged greenish G. Deciduous woods. $2 \times 2 \times \frac{1}{4}$. O. Edible.

**C. subalutacea** Gill. (167).—P. pale tan to whitish, tough, convex, then flattened; S. pale straw-colour, flexuose, elastic; G. pallid white, distant, adnato-decurrent; smell varying from anise to rancid meal. Woods. R. $2 \times 1\frac{3}{4} \times \frac{3}{8}$. Edible.

**C. rivulosa** Gill. (170).—P. whitish, pale flesh-colour to brownish ochre, appearing at first as if whitish varnished, cortex cracking in a rivulose manner; S. concolorous, minutely tomentose; G. flesh-colour. Pastures etc. C. $1\frac{3}{4} \times 1 \times \frac{3}{16}$. Suspicious.

19. **C. dealbata** Gill. (176). (Latin *dealbatus*, white-washed.)

Cap shining white like ivory, with greenish or orange-coloured zones near the margin, always dry, slightly fleshy, tough, at first convex, then plane, and at length revolute and undulated, even, smooth, innately pruinose under a lens; stem whitish dry, fibrous, at length hollow, stuffed, apex mealy; gills white, thin, crowded, adnate, scarcely decurrent; flesh white; smell and taste pleasant, mealy.

Woods, pastures, and downs. Common. July to Nov. $2\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{8}$. Edible.

Sometimes growing in profusion on mushroom-beds, often in company with *Clitopilus orcella*, which differs in having pink spores.

**C. cerussata** Quél. (171).—Entirely white. P. convex, then expanded, at first flocoso-fibrillose, margin involute and villous; base of S. thickened: G. adnato-decurrent, very crowded. Woods. F. $3\frac{1}{2} \times 2 \times \frac{3}{8}$. Suspicious.

**C. phyllophila** Quél. (172).—P. tan, becoming pale, same colour moist and dry, convex, then plano-depressed, often excentric and repand, margin silky; S. concolorous, elastic, fibrous, incurved and villous at the base; G. white, becoming yellowish, subdecurrent, subdistant. Woods, especially beech. C. $3 \times 2\frac{1}{4} \times \frac{3}{8}$. Suspicious.

**C. pithyophila** Gill. (173). Differs from 172 in its white P. and persistently white G., and in being somewhat hygrophanous. Pine woods. C. $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{16}$. Suspicious.

**C. tornata** Quél. (174).—Differs from 170 in its thinness, its regular form, its pure white unchangeable colour, and its more crowded G. Woods. O. $2 \times 2 \times \frac{1}{4}$. Edible.

**C. candicans** Quél. (175).—Wholly white. P. convex, then plane and depressed, umbilicate, sometimes excentric, pruinose, silky, shining; S. cartilaginous and polished like an *Omphalia*, base incurved, villose rooting; G. adnato-decurrent, crowded. Deciduous woods. C. $2 \times 1\frac{1}{2} \times \frac{1}{8}$. Edible.

*b.* Pileus fleshy at the disc, margin thin, at first umbonate, then expanded or depressed, irregular; cæspitose.

20. **C. elixa** Karst. (182). (Latin *elixus*, soaked—from its sodden condition in wet weather.)

Cap sooty brownish or greyish, becoming pale and somewhat silky when dry, fleshy at the disc, thin near the margin, convex, often depressed, but umbonate, undulato-repand, delicately virgate; stem fuliginous whitish, solid, velvety at the apex; gills white, unequally decurrent, distant, connected by veins; flesh dingy white, bibulous.

Woods. F. $5 \times 2\frac{1}{2} \times \frac{3}{4}$.

**C. fumosa** Quél. (183).—Differs from 182 in its obtuse P., which is often irregular but never virgate; S. tough, somewhat cartilaginous: G. grey-white to brownish white, crowded. Woods. F. $4 \times 3 \times \frac{3}{8}$. Edible.

**C. molybdina** Gill. (178 *a*).—P. dark bistre, becoming greyish, disc reddish, campanulato-expanded, minutely virgate; S. white, thickened at the base, fibrillosely striate, apex mealy; G. greyish or yellowish, sinuato-adnate; cæspitose. Woods. O. $5\frac{1}{2} \times 7 \times \frac{3}{4}$. Edible.

**C. decastes** Gill. (179).—Differs from 178 *a* in its larger size, in the white attenuated S. with naked apex, and in the white G. Woods etc. F. $9 \times 5 \times 1\frac{1}{2}$. Edible.

**C. aggregata** Gill. (181).—Differs from 179 in size, in its flaccid, often excentric, somewhat virgate P., its rufescent subfibrillose S., and flesh-colour to light yellow G.; smell strong; cæspitose. Oak woods, saw-dust heaps, etc. F. $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{3}{8}$. Edible.

**C. cartilaginea** Bres.—Is distinguished amongst the cæspitose species by its fuliginous, black, or chestnut P. with cartilaginous cuticle; G. white to straw-colour, subcartilaginous. Mixed woods. F. $4 \times 3 \times \frac{1}{2}$ Edible.

21. **C. opaca** Gill. (188). (Latin *opacus*, shady.)

Wholly white. Cap fleshy, at first convex, then expanded, umbonate, repand, covered with a floccose silvery glair; stem stuffed, subfibrillose, unequal, flexuose; gills adnato-decurrent, very crowded; flesh white. Usually caespitose.

Woods etc. F. $3 \times 2\frac{1}{2} \times \frac{1}{4}$.

**C. tumulosa** Sacc. (184).—Differs from 188 in its dark umber P. with drooping margin, its pallid, floccosely pruinose S., and its white to livid grey G.; smell faint of meal; cæspitose. Woods. F. $3 \times 3\frac{1}{2} \times \frac{3}{4}$. Edible.

**C. connata** Gill. (187 *a*).—Differs from 188 in having the P. slightly tinged with ochre, in the S. being mealy and swollen at the base, and in the distant G. being glaucous white to cream-colour. Parks. O. $2 \times 3 \times \frac{1}{2}$. Edible.

*c.* Pileus at length infundibuliform or deeply umbilicate.

22. **C. maxima** Quél. (190). (Latin *maximus*, greatest.)

Cap tan-colour, becoming pale tan or whitish, broadly infundibuliform, gibbous with a central umbo, fleshy at the disc, but thin towards the pubescent involute margin, very dry, becoming silky or squamulose: stem whitish, attenuate upwards, fibrillosely striate, spongy-solid, elastic; gills whitish, deeply decurrent, pointed at both ends, somewhat crowded, soft; flesh white, soft; smell and taste pleasant.

Grassy places. July to Nov. Frequent. $11 \times 5 \times 1\frac{1}{4}$. Edible.

(*Paxillus giganteus* Fr. (1172), which is often confused with this species, has no umbo, is less infundibuliform, has a sulcate margin, branched gills, and a short stem.)

**C. infundibuliformis** Quél. (191). (Latin *infundibuliformis*, funnel-shaped.)

Cap flesh-colour, becoming pale tan, convexo-depressed, gibbous with an umbo, fleshy at the disc, otherwise thin, moderately firm when young, margin involute, at length infundibuliform, softer, flaccid, silky, bibulous; stem pallid, thick, conico-attenuate, rarely equal, spongy-stuffed, firm, elastic base white tomentose; gills shining white, very decurrent, very much pointed at each end, somewhat crowded, soft.

Grassy places. Common. June to Dec. $3 \times 2 \times \frac{1}{4}$. Edible.

**C. incilis** Gill. (193).—Differs from 191 in the brick-red P. with crenate involute margin, in the concolorous hollow pruinose S., and in the slightly decurrent G. reticulated with veins; smell strong of meal. Coniferous woods. O. $2 \times \frac{3}{4} \times \frac{1}{4}$. Edible.

**C. sinopica** Gill. (194).—Differs from 193 in the even edge of the finely squamulose P., the solid S., and the white, very crowded G. becoming yellow; smell strong of meal. Woods, chiefly in burnt places. O. $1\frac{1}{2} \times 1 \times \frac{1}{4}$. Edible.

**C. parilis** Gill. (195).—P. fuscous, then greyish, disc atomate; S. blackish brown or reddish, tough; G. whitish greyish, deeply decurrent, very crowded. Woods. O. $2 \times 1\frac{1}{2} \times \frac{1}{4}$. Edible.

23. **C. geotropa** Quél. (198). (Greek *ge* earth, *tropos* turned—from the strongly inflexed margin of the young cap.)

Cap pale tan-coloured, very fleshy, convex, then plano-depressed, gibbous, even, very smooth, moist in rainy weather, guttate-spotted when young, margin thin, pubescent, and involute; stem white,

becoming yellow, subfibrillose, solid, fleshy, slightly attenuated upwards; gills white, becoming pale, deeply decurrent, somewhat crowded; flesh white; smell and taste pleasant.

Woods and pastures, often forming large rings. Common. Sept. to Dec? 6 × 6 × 1. Edible.

**C. gilva** Quél. (196). Differs from 198 in being wholly pale ochraceous with *concolorous flesh: margin of P. very involute, swollen, villose: G. very crowded,* often branched, and anastomosing. Pine woods. O. 3 × 2 × ½. Edible.

**C. subinvoluta** W. G. Sm. (197).—Differs from 196 in being wholly pale buff, at length slightly spotted or clouded buff or yellow, in the naked margin of the P., and in the fibrillose S. being attenuated upwards from the subbulbous base. Under firs. F. 3½ × 2½ × ¾. Edible.

**C. splendens** Gill. (200).—Differs from 196 in the non-flaccid, much thinner, not spotted P. with white mealy margin, and in the gills being at first white then pale yellow and less crowded. Woods. O. 4 × 2 × ½. Edible.

24. **C. flaccida** Quél. (202). (Latin *flaccidus*, flabby.)

Cap tawny ferruginous, not becoming pale, shining, slightly fleshy, tough, orbicular, flaccid when dry, fragile when fresh, at first umbilicate, then infundibuliform, never umbonate, smooth, even, rarely rimoso-squamulose, margin spreading: stem red-brown, elastic, tough, subequal, polished, thickened, villous at the base: gills whitish, becoming yellow, especially at the edge, deeply, almost obconico-decurrent, very arcuate, very crowded, narrow: flesh pallid.

Woods etc., often forming rings. Common. Sept. to Dec. Edible.

**C. inversa** Quél. (201).—Differs from 202 in the redder colour of the non-flaccid P., which is umbonate from the first, the whitish, hollow, non-elastic stem, the whitish gills which become red at the edge, and the pale brick-red flesh. Coniferous woods. C. 3½ × 3 × ¼. Edible.

**C. vermicularis** Quél. (203).—Differs from 201 in the deep flesh and tan colour of the slightly hygrophanous P., with pruinosely tomentose margin, the mealy apex of the S., the strigose mycelium at the base, and the white, then cream, and slightly decurrent G. Coniferous woods. O. 2 × 2 × ¼. Edible.

**C. catinus** Quél. (205).—Like *C. infundibuliformis* (191), having the same pleasant smell, but differing in being wholly white at first, becoming pale flesh-colour during rain. P. never gibbous, glabrous: when young with superficial down which soon disappears. Woods. F. 3 × 2 × ¼. Edible.

**C. tuba** Gill. (206).—Wholly white. Resembling *C. pithyophila* (173), but distinguished by the umbilicate P. and by the G. being deeply- and attenuato-decurrent. Coniferous woods. O. 2½ × 2¼ × $\frac{3}{16}$. Edible.

**C. ericetorum** Quél. (207).—P. globose, then turbinate and umbilicate, margin undulate: S. white, attenuated downwards, pubescent: G. somewhat decurrent, subdistant, often connected by veins; smell like that of sweet vernal grass. Resembling *Hygrophorus virgineus* (No. 90) in appearance. Heaths etc. O. 1½ × 1¼ × ¼. Edible.

ii. Pileus fleshy-membranous, hygrophanous.

*a.* Pileus cup-shaped: colour dingy when moist.

25. **C. cyathiformis** Quél. (208). (Greek *cyathus*, a cup; Latin *forma*, a form.)

Cap umber-black, becoming somewhat paler when dry, slightly fleshy, plano-depressed, then infundibuliform, even, smooth, hygrophanous, somewhat shining when moist, becoming pale and opaque

when dry, margin persistently incurved: S. concolorous or paler, elastic, attenuate upwards, fibrillose and somewhat reticulated, base white villous; G. cinereous-fuscous, adnate or decurrent, distant, joined at the base, sometimes branched; flesh watery, coloured like the gills.

Woods, pastures, rarely on rotten wood. Common. Aug. to Feb. $2 \times 2 \times \frac{3}{8}$. Edible.

A very variable species.

**C. expallens** Quél. (210).—Differs from 209 in being smaller, earlier, and paler in colour: margin of P. soon expanded and striate: S. white silky at the apex; G. white to cinereous, rather crowded, decurrent. Woods etc. F. $2 \times 1 \times \frac{3}{16}$. Edible.

**C. obbata** Quél. (211). Resembles 209 in colour, but differs in being more slender, in its striate P. and distant G., which become white pulverulent. Woods etc. O. $1\frac{1}{2} \times 2 \times \frac{3}{16}$. Edible.

**C. pruinosa** Quél. (212).—Differs from 209 in the brown lead-grey pruinose P., the brown often curved or ascending S., and the white, then dingy, decurrent G. Pine woods. $3 \times 1\frac{3}{4} \times \frac{1}{4}$. Edible.

**C. concava** Gill. (213).—P. grey or olive-brown, deeply umbilicato-depressed, very thin, flaccid, border undulated: S. ashy grey, tough, smooth, base attenuate: G. coloured as P., very crowded. Like an *Omphalia* in appearance. Coniferous woods. R. $2 \times 1 \times \frac{3}{16}$. Edible.

**C. suaveolens** Quél. Differs from *C. fragrans* (219) in the white, convex, then concave P., hygrophanous with a darker disc when moist, and the white or pinkish S. with swollen villous base. Woods. O. $1 \times 1\frac{1}{2} \times \frac{1}{4}$. Edible.

**C. brumalis** Quél. (214).—Differs from 213 in its livid umbilicate, then infundibuliform, waved and lobed P., generally darker at the disc, and the livid G., which become yellowish or whitish. Woods etc. C. $2 \times 2 \times \frac{1}{2}$. Edible.

**C. orbiformis** Gill. (214*a*).—Differs from *C. cyathiformis* in the convexo-plane very obtuse P. Pine woods. R. $2 \times 3 \times \frac{1}{4}$.

*b.* Pileus somewhat fleshy, convex, then flattened or depressed, polished; colour dingy or becoming pale.

**C. metachroa** Quél. (215). P. ochreous whitish to brownish grey, convex, somewhat umbonate, then plane and depressed, margin at length striate: S. pruinose at the apex; G. cinereous whitish, scarcely decurrent. Pine woods. C. $1\frac{3}{4} \times 2 \times \frac{1}{4}$. Edible.

**C. ditopa** Gill. (217). Differs from 215 chiefly in the strong mealy smell. P. cinereous, drying deep ochre, tough, often undulate-lobed: S. pale cinereous, naked, compressed. Woods. C. $1\frac{3}{4} \times 2 \times \frac{1}{4}$.

**C. fragrans** Quél. (219). (Latin *fragrans*, sweet-scented.)

Cap watery, pallid when moist, whitish when dry, slightly fleshy, convex, then plane or somewhat depressed, smooth, margin slightly striate when moist: stem concolorous or yellowish, stuffed, then hollow, elastic, equal, smooth, even, apex obsoletely pruinose, base often villous; gills whitish, adnato-decurrent, sharp-pointed behind, rather crowded, broader than the watery flesh of the cap: smell and taste of aniseed.

Woods and pastures. Common. July to Jan. $2\frac{1}{4} \times 3 \times \frac{3}{16}$. Edible.

Often attacked by *Syzygites* (*Sporodinia*) *megalocarpus* Ehrb. (Mucoraceæ).

**C. diatreta** Quél. (218).—Is distinguished by its flesh-colour when moist, becoming tan-colour, flaccid, margin spreading, naked, and whitish when dry; S. pallid, naked at the apex; G. white flesh-colour, then whitish, adnate, decurrent, with a tooth. Coniferous woods. O. $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{4}$. Edible.

**C. angustissima** Gill. (220).—Differs from 219 in being inodorous, and shining white when dry. P. cream to flesh-colour, margin spreading; S. concolorous, often flexuose: G. white, very crowded, narrow. Woods. O. $2 \times 2\frac{1}{2} \times \frac{1}{8}$. Edible.

**C. obsoleta** Quél. (221).—Intermediate between *C. fragrans* (219) and *C. metachroa* (215). P. pale grey or flesh-colour, soon white, plano-depressed, hygrophanous: S. often compressed, apex pruinose: G. pale grey, then white, adnato-decurrent, somewhat broad, crowded. Amongst grass and leaves. O. $2 \times 3 \times \frac{1}{8}$. Edible.

*c.* Pileus tough, more or less squamulose or furfuraceous.

26. **C. laccata** Quel. (224) (*Laccaria*) (from the colour of the cap, which resembles that of gum-lac).

Cap rufous flesh-colour, carnation or brick-red when moist, ochraceous when dry, convex, then somewhat plane, more or less umbilicato-depressed, thin, almost membranaceous, dry but very hygrophanous, cuticle separating into mealy squamules or somewhat silky, sometimes undulato-crisped and variously irregularly shaped: stem concolorous, white villous at the base, tough, fibrous stuffed, equal, fibrillose, often flexuose or twisted: gills flesh-colour, at length white mealy, adnate with a decurrent tooth, very broad, distant, plane, thick; flesh concolorous; smell sometimes of garlic.

Woods, heaths, etc. Common. June to Dec. $2 \times 3 \times \frac{3}{8}$. Edible.

The variety *amethystina* differs in the whole of the plant, including the flesh, being a deep violet colour, becoming paler when dry. This is equally common with the type, and intermediate types occur between the two.

The genus *Laccaria* was proposed for this species and its allies on account of their echinulate or verrucose spores.

## VIII. COLLYBIA Quél.

(Greek *kollubos*, a small coin—from the frequently regular form and small size of the cap.)

Fig. 12.—*Collybia fusipes* Quél. (× ¼.)

The cartilaginous stem is one of the characteristic features of this genus; the cap is slightly fleshy with an involute margin when young; the gills are free or slightly adnate and soft. Growing on wood or on the ground, often deeply rooting, sometimes arising from sclerotia. Probably no species are poisonous. There are about eighty British species.

*Marasmius* differs in being wholly dry and leathery, and in reviving with moisture.

i. Gills white or brightly-coloured, not cinereous.

*a.* Stem stout, sulcate, or fibrillosely striate.

27. **C. radicata** Quél. (225). (Latin *radicatus*, rooted.)

Cap greyish brown to smoky brown, fleshy, thin, sometime whitish, convex, then flattened, gibbous, often irregular, glutinous,

radiato-rugose: stem pale brown or white, straight, rigid, stuffed, attenuate upwards from the soil level, prolonged into the ground as a tail-like fusiform root which is sometimes attached by mycelial strands to remains of roots or rotten wood, smooth, at length striato-sulcate, cuticle cartilaginous, often twisted: gills shining white, sometimes bistre at the edge, attenuated behind and adfixed, often with a decurrent tooth, at length somewhat separating, ventricose, distant: flesh white, soft, elastic.

On and about stumps, etc., covered with soil. Common. June to Nov. $5 \times 1$ $2\frac{1}{2} \times \frac{3}{4}$. Edible.

The viscidity of the cap is almost absent in dry weather and in the young state. The fungus varies much in size, being frequently only an inch or less across the cap. In the Department of Botany there is a drawing of a specimen with a cap $8\frac{1}{2}$ inches in diameter and a stem (including the rooting base) 22 inches long.

**C. longipes** Quél. (226). Differs from 225 in the dry, somewhat velvety, villous P. and the dark brown, velvety, villous S. with yellow flesh. On stumps etc. F. $2 \times 9 \times \frac{1}{4}$. Edible.

**C. platyphylla** Quél. (227). P. flat, fuscous, or cinereous, becoming whitish, streaked with bistre fibrils: S. whitish, fibrilloso-striate, springing from an abundant cord-like mycelium which attaches itself to bits of wood, twigs, etc.: G. white, very broad, distant. Woods. C. $5 \times 5 \times \frac{1}{4}$. Edible.

28. **C. fusipes** Quél. (229). (Latin *fusus*, a spindle, *pes*, a foot.)

Cap rufescent reddish-brown or liver-colour, becoming pale or dingy tan, fleshy, convex or flattened, umbo evanescent, even, smooth, dry, often cracking: stem concolorous, fibrous, stuffed, then hollow, very cartilaginous, swollen, ventricose in the middle, attenuated at both ends, often twisted, longitudinally striato-sulcate, fusiformly attenuated and blackish at the base; gills whitish, then concolorous, often spotted, adnexed, soon separating, free, broad, distant, firm, connected by veins, crisped; flesh concolorous, becoming whitish, firm.

Cæspitose on old stumps. Common. May to Dec. $2 \times 4 \times \frac{1}{2}$. Edible.

The fungus usually grows from a black sclerotium-like body, which is the remains of previous years' growth. The cartilaginous cuticle of the stem often cracks in dry weather, forming revolute flaps.

**C. lancipes** Gill. (229*a*).- Differs from 229 in the radiately rugose P., often white at the striate margin, and in not being cæspitose. Much the colour of *Mycena pura* (No. 32). On the ground. O. $2\frac{1}{2} \times 5 \times \frac{3}{4}$. Edible.

29. **C. maculata** Quél. (230). (Latin *maculatus*, spotted.)

Cap creamy or pale buff colour, spotted and stained foxy red, fleshy, very compact, convexo-plane, obtuse, repand, even, smooth, margin thin and involute at first; stem whitish, spotted rufescent, hard, externally cartilaginous, somewhat ventricose, striate, base attenuated, sometimes rooting: gills cream-colour, often spotted rufescent, emarginato-free, very crowded, linear, denticulate; flesh white, thick, firm.

Beech and pine woods. Common. May to Nov. $3\frac{1}{2} \times 4\frac{1}{2} \times \frac{1}{2}$. Edible. Occasionally the whole plant becomes rufescent with age.

**C. prolixa** Gill. (232).—Differs from 230 in its rusty brick-red P. and S., which become pale: P. lax, gibbous: S. subequal, often scrobiculate: G. white, not spotted. Dense clusters of leaf-heaps. O. 5×4½×½. Edible.

**C. butyracea** Quél. (234). P. rufous brown, becoming pale with a darker marginal zone, umbo almost black, greasy: S. rufous, with a rigid cartilaginous cuticle, striate, conico-attenuated from the thickened white tomentose base: G. white, crowded, crenulate. Woods etc. C. 3×2½×½. Edible.

*b.* Stem thin, velvety, floccose or pruinose.

30. **C. velutipes** Quél. (237). (Latin *vellus*, fleece, *pes*, a foot—from the velvety stem.)

Cap tawny yellow, sometimes paler at the margin, convex, soon becoming plane, moderately fleshy at the disc, but thin at the circumference, often eccentric, irregular and repand, smooth, viscid, margin spreading and at length striate; stem yellow above, brown and almost black towards the base, or wholly brown, tough, cartilaginous, usually ascending or twisted, equal, covered with dense velvety down; gills pallid white or yellowish, becoming tawny, broader and rounded behind, adnate or adnexed, subdistant, very unequal: flesh yellowish, watery, and soft; taste and smell agreeable.

Cæspitose, on stumps etc., often parasitic. Common. Aug. to April. 2½×2¾×¼. Edible. The stem is seldom so attenuate as shown in the model.

The stem and mycelium are said to be frequently luminous.

**C. hariolorum** Quél. (243).—P. whitish, campanulato-convex, then flattened, submembranous, margin substriate; S. reddish brown, apex pallid, covered with whitish woolly down, cartilaginous, somewhat compressed: G. whitish, adnato-free: odour strong; subcæspitose. Woods. O. 2×2½×¼. Suspicious.

**C. confluens** Quél. (244).—Differs from 243 in the more compressed stems (which occasionally become united) having dilated apices, and being wholly rufous and white downy, and in the very crowded free G., which are at length remote from the S.; often connate. Woods. 2×3×¼. Edible.

**C. ingrata** Quél. (245).—Differs from 244 in the dingy fuscous tan P., in the twisted S. not being flattened at the apex, and in the G. not leaving a free space round the S. apex; smell mouldy, taste bitter; cæspitose. Woods. O. 1×2×¼. Suspicious.

**C. conigena** Quél. (246). P. fuscous, then paler, subumbonate: S. white, then ochraceous, apex white pruinose, rooting base long and fibrillosely tomentose: G. cinereous, then white, often becoming yellowish, sinuato-adnexed, very crowded; taste somewhat bitter. On buried fir-cones. C. 1×2×⅛. Edible.

**C. cirrhata** Quél. (247).—Differs from 246 in its white, somewhat silky P., with rufescent or ochraceous disc and pallid, white, pulverulent, filiform, flexuous S. with fibrillose, twisted root arising from a flat yellowish sclerotium (*Sclerotium truncorum* Fr.). Amongst leaves and on fungus remains. C. ¾×3×$\frac{1}{16}$.

**C. tuberosa** Quél. (248).—Differs from 247 in the white umbonate P. with ochraceous disc, and the white or rufescent stem with glabrous root, arising from an elongated, ochraceous or purplish-blackish, clavate or elliptical sclerotium (*Sclerotium fungorum* Pers.). On decaying Agarics etc. C. ¾×3×$\frac{1}{16}$.

**C. racemosa** Quél. (249). Differs from 248 in its grey, papillose, tomentose, striate P. and in its proliferous S., which arises from a swollen brown, then black, sclerotium (*Sclerotium lacunosum* Pers.); G. concolorous. On rotten fungi. R. ¾×2×$\frac{1}{32}$.

The lateral branches of the S. instead of pilei bear globose heads, which are composed of conidia capable of germination.

c. Stem thin, glabrous.

**C. collina** Quél. (250).—P. pale fuscous or pale tan, expanded, subumbonate, somewhat viscid; S. whitish, apex mealy, base abrupt and pubescent; G. white, adnexo-toothed, veined at the base. On grassy slopes. O. 2×4×¼. Edible.

**C. nitellina** Gill. (256).—P. tawny or brick tawny, becoming pale, convexo-plane, polished; S. ferruginous tawny, cartilaginous, shining, base white villous; G. white or yellow, then flesh-colour, adnate; smell rancid. Coniferous woods. O. 2×3×¼. Edible.

According to Maire the spores are bright brownish red in the mass, yellowish under the microscope.

**C. succinea** Quél. (257).—Differs from 256 in the deep rich brown P. and S.; P. rimosely split when dry; G. cream-colour, rather thick, delicately toothed. Coniferous woods. F. 1½×1½×¼. Edible.

**C. esculenta** Quél. (259). P. cinnamon-brown to pale yellow, convex, then plane, margin at first pellucidly striate; S. white, then concolorous, apex pruinose, rooting base long and fibrillosely tomentose; G. white, often yellowish at the edge, rounded behind, adnexed, crowded; taste slightly bitter. On buried fir-cones. C. 1×3×1/16. Edible.

31. **C. dryophila** Quél. (262). (Greek *drus*, oak, *philos*, loving.)

Cap livid brown, rufous, yellow, ochraceous or whitish, becoming pale, slightly fleshy, tough, convexo-plane, obtuse, commonly depressed in the centre, even, smooth, margin inflexed, then flattened; stem whitish, yellowish, or rufescent, cartilaginous, fistulose, even, smooth, somewhat rooting; gills white or becoming pale, almost free, but slightly sinuate, crowded, narrow; flesh white.

Woods etc. Common. May to Oct. 3×5×¼. Edible.

Remarkably variable: there are several distinct forms.

**C. aquosa** Gill. (263). Differs from 262 in being wholly pale tan, becoming white; P. not depressed, hygrophanous, margin striate. Woods etc. C. 2×3×¼. Edible.

**C. extuberans** Quél. (264).—Differs from 262 in the umbonate P., slightly viscid when moist, and the tense and straight, rooting S.; P. and S. rufous to bay-brown. On the ground and on stumps. O. 2×3×¼. Edible.

ii. Gills becoming cinereous: hygrophanous.

**C. rancida** Quél. (271).—P. lead-colour or fuliginous, disc blackish or umber, silky-white pruinose at first, broadly and obtusely umbonate; S. concolorous, smooth, base attenuated into a long, fusiform, villous root; G. dark grey; smell like rancid meal. Woods. C. 1½×4×¼. Suspicious.

**C. coracina** Gill. (273).—Differs from 271 in the shorter stem, which is swollen at the base and not rooting. P. fuscous and shining, grey and opaque when dry, hygrophanous; S. becoming fuscous, apex mealy squamulose; G. whitish grey; odour of meal. Coniferous woods. O. 1½×1½×¼. Edible.

**C. ozes** Karst. (274). Differs from 273 in the smoky olivaceous G. and the lax, flexuose, fragile, slightly striate, smooth, grey S.; P. grey to clay-fuscous, margin striate when moist; odour of meal. Coniferous woods. R. 1×3×¼. Edible.

**C. inolens** Quél. (275).—P. livid, becoming pale tan, obtusely and broadly umbonate, hygrophanous, margin inflexed at first, then expanded, striate, and umbonate; S. concolorous, apex white squamulose, base white strigose; G. grey; smell weak of meal. Coniferous woods. O. 2×3×¼. Suspicious.

**C. plexipes** Gill. (276).—P. blackish with whitish margin, becoming greyish, campanulate, umbonate, somewhat wrinkled, substriate; S. livid, cartilaginous, covered with a network of silky fibrils, substriate, bluntly rooting; G. white, then glaucous. Beech woods. O. 1¼×6×¼. Edible.

**C. lacerata** Gill. (279).—P. sooty brown, campanulate, then convex and umbilicate, fibrillosely streaked, margin fimbriately torn and splitting: S. pallid, fibrillosely striate, finally compressed and often twisted, apex floccosely pruinose, base white-tomentose, somewhat rooting; G. whitish grey. Cæspitose on pine stumps. R. 2×3×¼. Edible.

**C. murina** Gill. (280). Differs from 279 in the rugulosely squamulose P. with involute margin, and in the white to cinereous S. being straight, delicately fibrillose, and not rooting: G. white, becoming cinereous. Woods. O. 1×2½×¼. Edible.

## IX. MYCENA.

(Greek *mukes*, a fungus.)

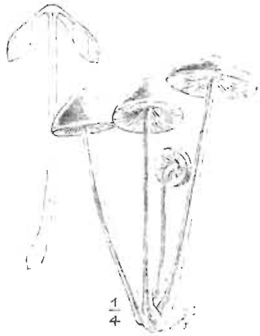

Fig. 13.—*Mycena polygramma* Quél. (× ¼.)

Cap membranous, campanulate, and umbonate, usually smooth and more or less striate at the margin, which is straight at first and applied to the stem and never incurved as in *Collybia*; the stem is cartilaginous, slender, and hollow; the gills are adnexed or adnate, never truly decurrent. Most of the species are small, some minute; some are very fragile and fugitive, others are firmer and more persistent. Growing on the ground amongst leaves or on stumps, often in clusters. Probably no poisonous species occur in the genus, but, on account of their small size and cartilaginous nature, the vast majority are worthless. There are about a hundred British species.

Most species are without odour, but many have a strong nitrous scent (e.g., *M. alkalina* Quél., 325; *M. ammoniaca* Quél., 326), whereas in others it is of radish (e.g., *M. pelianthina* Quél., 287, and *M. pura* Quél., 298).

The base of the stem is dilated into a disc in *M. stylobates* Quél. (357) and its allies. Several species exude a milky juice from their gills or stem when broken; this is white (*M. galopus* Quél., 318) or coloured (red or blood-red in *M. hæmatopus* Quél., 343). The members of this genus are often attacked by *Spinellus macrocarpus* Karst. (Mucorineæ).

32. **M. pura** Quél. (298). (Latin *purus*, clean.)

Cap rose-colour varying to purple, lilac, violet, bluish-grey, white, or yellow, slightly fleshy at the disc, campanulate, then expanded, at length rather plane, umbonate, striate at the margin, very brittle, and semi-transparent: stem concolorous, hollow, somewhat tough and rigid, smooth, villoso-fibrillose at the base; gills pallid or whitish, adnate, very broad, ventricose, connected by a network of veins; flesh white: taste and smell of radish.

Woods and meadows. Common. June to Dec. 2×4×¼. Suspicious.

33. **M. polygramma** Quél. (314). (Greek *polus*, many, *gramme*, a line—from the longitudinally striate stem.)

Cap fuscous, cinereous, livid, or becoming light yellow, rarely shining white, membranous, conical, then campanulate, slightly umbonate, dry, smooth, striate, with the margin white when young

and frequently toothed; stem silvery grey, varying to livid and azure-blue, appearing shining metallic, rigid, tense and straight, equal, naked, hollow, longitudinally striato-sulcate, base strigose-rooted: gills white or pinkish, broad in front, adnexed, almost free, subdistant, sometimes serrulate; flesh greyish.

In clusters and stumps. Common. Aug. to Sept. $2 \times 6 \times \frac{1}{4}$. Edible.

**M. galericulata** Quél. (313).—Differs from 314 in its P. being broadly umbonate and striate to the umbo, in the S. being smooth and strigosely fusiform rooted, in the G. becoming flesh-colour (and in the basidia being bisporous). Cæspitose. on stumps. C. $2\frac{1}{2} \times 5 \times \frac{1}{8}$ Edible.

**M. rugosa** Quél. (311).—Differs from 313 in the P. being rugulose and G. not becoming flesh-colour (and in the basidium being quadrisporous). $2\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{4}$.

34. **M. epipterygia** Quél. (350). (Greek *epi*, upon, *pteris*, bracken—from its frequent habitat.)

Cap cinereous, grey, or yellow, becoming whitish, membranous, campanulate, at length more expanded, obtuse, never depressed, striate, covered with a pellicle, which, when the plant is moist, is very viscous, and in every state easily separable; stem yellow, varying to pallid cinereous or whitish, tough, hollow, even, rooted and white fibrillose at the base, viscous; gills whitish or greyish, adnate with a decurrent tooth: flesh whitish.

Woods, pastures, etc. Common. Aug. to Dec. $\frac{3}{4} \times 5 \times \frac{1}{16}$.

**M. vulgaris** Quél. (353).—P. brownish or cinereous, convex, disc depressed, substriate, papillate, subviscid, pellicle separable; S. cinereous, very viscid, base rooting and white strigose; G. white or grey. Coniferous woods. C. $\frac{1}{2} \times 2 \times \frac{1}{32}$.

**M. rorida** Quél. (356).—Wholly white or sometimes with a greyish tinge or P. becoming yellow; P. sulcate when moist, even when dry, margin crenate; S. filiform, covered with a thick fluid, shining, hyaline gluten: G. distant. On twigs. C. $\frac{1}{2} \times 2 \times \frac{1}{32}$.

35. **M. corticola** Quél. (362). (Latin *cortex*, bark, *colo*, to inhabit.)

Cap generally blackish, becoming azure-blue, fuscous, or ashy grey, thin, hemispherical, obtuse, at length subumbilicate, sulcate, smooth or pruinose: stem paler than the cap, generally incurved, smooth or slightly furfuraceous, hollow; gills paler than the cap, adnate, with a small decurrent tooth, broad, somewhat ovate, distant; flesh concolorous.

On living trunks. Common. June to Jan. $\frac{1}{4} \times 1 \times \frac{1}{32}$.

**M. hiemalis** Quél. (363).—Differs from 362 in the whitish to rufescent non-sulcate P. with striate margin, in the white erect or ascending S. pubescent downwards, and in the narrow, linear, white G. On trunks. C. $\frac{1}{4} \times 1 \times \frac{1}{16}$.

**M. setosa** Gill. (364).—Wholly white. P. often becoming brownish, hemispherical: S. filiform, everywhere shaggy with distinct spreading hairs: G. adnate, distant. On beech leaves. F. $\frac{1}{16} \times \frac{3}{4} \times \frac{1}{100}$.

**M. capillaris** Quél. (365).—Wholly white. P. at first like a small pin's head, then campanulate, slightly striate when moist; S. capillary, hollow, flaccid, apex becoming fuscous; G. adnate, few, broad. On beech leaves. C. $\frac{1}{16} \times \frac{3}{4} \times \frac{1}{100}$.

## X. OMPHALIA Quél.

(Greek *omphalos*, an umbilicus.)

The cap is usually thin, depressed, or infundibuliform, the gills decurrent, and the stem externally cartilaginous; the species are

mostly small and grow usually on twigs and wood. There are about forty British species. Few are of sufficient size to be of culinary value; none are known to be poisonous. Agreeing with *Clitocybe* in having decurrent gills with a thin edge, but differing in the smooth, polished, cartilaginous stem.

Fig. 14.—*Omphalia umbellifera* Quél. (Nat. size.)

36. **O. pyxidata** (Quél. (373). (Latin *pixidata*, box-shaped.)

Cap reddish brown and radiato-striate *when moist*, *paler*, *opaque* floccose or slightly silky when dry, membranous, pellucid, umbilicate, then infundibuliform, very hygrophanous; stem pallid, then rufescent, tough, equal, smooth, or pruinose; gills flesh-colour, then pale yellowish, decurrent, somewhat distant, narrow; flesh pallid.

Amongst grass in lawns, woods, etc. Common. July to Nov. $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{8}$.

37. **O. muralis** Quél. (385). (Latin *muralis*, belonging to a wall—from the frequent habitat.)

Cap red-brown, submembranous, tough, convex, umbilicate, then infundibuliform, radiato-striate, smooth, margin crenulate; stem concolorous, equal, smooth, with white floccose base; gills pallid flesh-colour, decurrent, distant; flesh concolorous.

On old damp mossy walls, turf-banks, bare soil in woods. Jan. to Dec. $1 \times \frac{3}{4} \times \frac{1}{8}$.

**O. umbellifera** Quél. (386).—P. deep brown to ochraceous whitish, convex, then plane, broadly obconic, subumbilicate, radiately striate, silky when dry, margin crenate; S. concolorous; G. white, greyish white, or yellowish, very distant, broad, triangular. Extremely variable. Boggy ground. C. $1 \times 1 \times \frac{1}{16}$.

**O. hydrogramma** Quél. (367).—Livid when moist, whitish when dry. P. deeply umbilicate, flaccid, with spreading, undulate, striate margin; S. very cartilaginous, base rooting and white tomentose; G. deeply decurrent, very crowded; subcaespitose. On beech leaves. G. $2\frac{3}{4} \times 3 \times \frac{1}{4}$. Edible.

**O. umbilicata** Gill. (368).—Differs from 367 in its disc becoming fuscous and in the P. becoming infundibuliform with reflexed margin, in the S. apex silky striate with white fibrils, and in the G. being less crowded. Amongst moss. O. $1\frac{3}{4} \times 1\frac{1}{2} \times \frac{1}{8}$. Edible.

**O. maura** Gill. (369).—Differs from 367 in its P. being sooty brown and striate when moist, silvery when dry, margin deflexed, in its somewhat horny, brownish-black S., and shining white G.; odour of meal. Pastures. F. $2 \times 1\frac{1}{2} \times \frac{1}{8}$. Edible.

**O. fibula** Quél. (398) is characterised by its small size and orange-yellow colour. P. plano-depressed, at length infundibuliform, striate when moist; G. deeply decurrent, subdistant, drying pale. On mossy ground. C. $\frac{1}{2} \times 2 \times \frac{1}{32}$.

The var. *Swartzii* Karst. has an umbilicate fuscous disc and whitish stem with violaceous apex.

## XI. PLEUROTUS Quél.

(Greek, *pleuron*, a side, *ous*, an ear—from the ear-like appearance in many species.)

The cap is fleshy or submembranous, usually excentric, sometimes resupinate; the stem is commonly excentric or lateral, but may be

absent; a ring is present in a few species; the gills are decurrent, sinuate, or adnate, somewhat radiating from a central point. Usually lignicolous. There are about forty British species.

i. Pileus laterally extended; stem excentric.

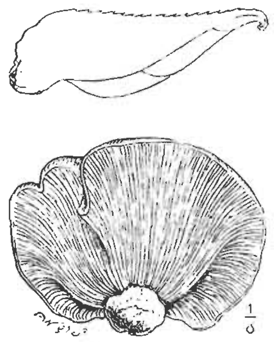

Fig. 15.—*Pleurotus corticatus* Quél. (× ½.)

38. **P. ulmarius** Quél. (410). (Latin *ulmarius*, belonging to elm—from the usual habitat.)

Cap ochraceous, becoming livid whitish, often marbled with round spots, fleshy, compact, convex, then plane, disc-shaped, regular in form, but excentric, even, smooth, horizontal, sometimes cracked in a tessellate manner; stem white, becoming tinged with yellow, thick, solid, firm, elastic, somewhat excentric, curved-ascending, thickened and tomentose at the base, sometimes villous throughout; gills whitish or pale ochraceous, *emarginate or rounded behind*, slightly adnexed, broad, horizontal, somewhat crowded; flesh white; smell and taste pleasant or slightly acrid.

On trunks, especially elm. Common. June to Dec. 6 × 4 × 2. Edible.

**P. corticatus** Quél. (407). -Differs from 410 in the presence of a white silky-floccose R.; P. whitish grey covered with dense grey down which separates into floccose scales, margin involute and often fimbriate with the veil; S. whitish, squamuloso-fibrillose, more or less excentric; G. white, becoming yellow, deeply decurrent, subdistant, dichotomously branched, anastomosing at the base. Cæspitose on trunks. F. 9 × 3½ × 1½. Edible.

**P. dryinus** Quél. (408). -Differs from 407 in the whitish P. with the floccose scales becoming fuscous, in the sublateral S., and in the G. being less decurrent, simple, and narrow. Trunks. F. 9 × 3½ × 1½. Edible.

**P. tessulatus** Gill. (411). Differs from 410 in its grey to tawny P. variegated with spots, its very excentric S., its white or faintly yellowish sinuate G., and its mealy odour. Trunks. 4 × 2 × ¾. Edible.

39. **P. subpalmatus** Gill. (412) (*Entoloma Cookei* Rich. 489, *a*).

Wholly pale orange-buff, nankeen, or rufescent flesh-colour. Caps convex, then flattened, obtuse, imbricated, and glued together, horizontal, more or less excentric, smooth, but covered with a thick, tough, gelatinous, closely adnate pellicle which exudes limpid, rufescent, astringent drops, reticulato-corrugated towards the margin, which is at first involute; stem at first whitish, fibrilloso-striate, equal, curved, ascending, at length hollow; gills paler than the cap, rounded behind, and *joined in a collar, sinuate, connected by veins*, broad, crowded; flesh like raw veal; smell pleasant; taste bitter, aromatic; spores pink or yellowish.

Cæspitose on elm-trunks, old posts, squared timber. Frequent. *Sept. to Jan.* 4½ × 2½ × ½.

**P. fimbriatus** Gill. (414).—P. whitish, hyaline, hygrophanous, plane, then infundibuliform, more or less excentric, pruinose, margin sinuato-lobed and incised; S. concolorous, base pubescent; G. white, adnate, very narrow, very thin, very crowded; smell mealy. On beech stumps. R. $4\frac{1}{2} \times 1\frac{3}{4} \times \frac{1}{4}$. Edible.

**P. circinatus** Gill. (417).—Differs from 414 in being wholly white and not hygrophanous, in its regular, orbicular, shining, somewhat silky P., its broad G., and absence of mealy smell. On birch stumps. O. $2\frac{3}{4} \times 1\frac{3}{4} \times \frac{1}{4}$. Edible.

**P. sapidus** Sacc. (418). P. white or light yellow, becoming fuscous or umber, excentric, subsessile, deformed, plano-depressed; S. white or pale yellow, thickened upwards, connato-branched, arising from a fleshy, bulbous, white base; G. pallid, decurrent, subdistant, anastomosing on the S.; spores lilac in the mass. Elm *trunks*. F. $4\frac{1}{4} \times 2\frac{1}{4} \times \frac{3}{4}$.

40. **P. ostreatus** Quél. (421). (Latin *ostreatus*, oyster-shaped.)

Cap almost black when young, soon becoming pale, slate, or brownish, passing into yellow when old, fleshy, soft, conchate, somewhat dimidiate, ascending, smooth, moist, cuticle sometimes torn into squamules; stem white, short, or wanting, firm, elastic, ascending obliquely, dilated above into the cap, base strigosely villose; gills white, sometimes turning light yellow, decurrent, anastomosing near the stem, subdistant, broad; flesh white; taste and smell pleasant; spores lilac in the mass.

On stumps, trunks, etc. Jan. to Dec. C. $5 \times 2 \times 1$. Edible.

French peasants are stated to water the trunks on which the fungus is known to occur, in order to obtain specimens for culinary purposes.

**P. euosmus** Sacc. (422) is distinguished from 421 by its strong sweet smell, like that of tarragon. Suspicious.

**P. salignus** Quél. (424). Differs from 421 in the P. being compact and more pulvinate when young, then depressed, here and there strigose, in the tan subtomentose S., and in the G. being dingy fuliginous, thinner, more crowded, branched, but not anastomosing, with the edge often eroded. Trunks. O. $5\frac{1}{2} \times \frac{1}{2} \times 1\frac{3}{4}$. Edible.

When developed in the absence of light the fungus takes the form of *Clavaria*-like bodies.

ii. Pileus definitely lateral, immarginate behind, not at first resupinate.

**P. serotinus** Gill. (428).—P. olivaceous, reniform, pellicle viscid in wet weather, margin at first involute; S. wanting or lateral, yellow with a fuliginous or brownish squamulose zone near the bright yellow, adnate, crowded, branched G.; flesh white, with a gelatinous layer under the cuticle of the P. Trunks. O. $2 \times \frac{3}{4} \times \frac{1}{2}$. Edible.

41. **P. tremulus** Quél. (434). (Latin *tremulus*, shaking.)

Cap fuscous grey, becoming pale, hygrophanous, slightly fleshy, dimidiate, somewhat horizontal, reniform, plane, depressed, and often villous behind; stem grey, lateral, ascending-vertical, sometimes very short, round, somewhat thin, and dilated upwards, attached to the matrix by a woolly mass; gills grey, adnate or decurrent, very unequal, linear, narrow, subdistant; flesh pallid.

Growing on mosses, fungi, rotten wood, or on the ground. Uncommon. Aug. to Dec. $1\frac{1}{4} \times \frac{3}{16} \times \frac{1}{4}$.

**P. acerosus** Quél. (435). Differs from 434 in its membranous, striate, flaccid P., its whitish S. *with strigose rooting-base, and its pallid crowded G.*; P. sometimes brown, silky white when dry. Twigs etc., coniferous woods, *Sphagnum*. C. $2 \times \frac{1}{4} \times \frac{1}{8}$.

iii. Pileus at length reflexed, sessile: gills radiating from an excentric point.

**P. porrigens** Gill. (436).—Wholly shining white. P. at first resupinate, sessile, at length plano-depressed, undulate, pruinose, tomentose towards the base, diaphanous; G. at first concurrent, then decurrent, often branched, very narrow, crowded. On coniferous stumps. R. Diam. 6 inches.

**P. applicatus** Quél. (444).—Wholly dark cinereous. P. cup-shaped, then expanded or reflexed, orbicular, adnate behind, villose at the base; G. whitish at the edge, few, rather thick, broad, radiating from a white umbilicus; flesh grey, upper layer gelatinous. Dead branches etc. C. Diam. ⅔ inch.

SPORES PINK.

## XII. VOLVARIA Quél.

(Latin *volva*, a wrapper.)

*Volvaria* agrees in structure with *Amanitopsis*, *Acetabularia*, and *Chitonia*, but has white spores. The cap is fleshy and regular; the stem is provided at its base with a membranous, free, sheathing volva; the gills are free. Terrestrial or lignicolous, excepting *V. Loveiana*. There are about ten British species.

Fig. 16.—*Volvaria volvacea* Quél. (× ⅕.)

42. **V. volvacea** Quél. (450). (Latin *volvaceus*, having a volva.)

Cap cinereous, black, streaked with adpressed fibrils, campanulate, then expanded, obtuse; stem white, solid, and almost equal; volva whitish, fuscous at the apex, oval, membranous, lax, often adpressed to the stem; gills white then flesh-colour, free, ventricose; flesh white.

Roadsides, stoves, etc. Uncommon. July to Oct. 5 × 7 × ½. Very suspicious.

This species is often troublesome in hothouses, owing to its profuse growth on tan. The mycelium often spreads up the walls from the floor to the shelves. As in the case of the mushroom, the mycelium sometimes passes through the mortar between the bricks and produces a second crop outside the building.

The model is remarkable in showing an ample ring on the stem. If such were normal, the fungus would belong to *Metraria*, an Australian genus.

**V. bombycina** Quél. (449). Differs from 450 in the white, silky, then squamuloso-villous P., in the V. being laciniate and somewhat viscid, and in the G. having an eroded edge. Stumps, saw-dust, etc. O. 8 × 7 × ¾. Edible.

**V. Loveiana** Gill. (451) is distinguished by growing on the P. of *Clitocybe nebularis*. P. white, silky, convex, margin involute; S. white, fibrillose, lax, bulbous; V. white, lax; G. white, then pale pink. O. 3 × 2 × ⅜.

**V. speciosa** Gill. (454).—P. whitish, greyish, or brownish, viscid, globose, then campanulate, at length plane; S. white, base villous when young; V. white, membranous, bulbous, free, variously torn, externally tomentose; odour often strong. Dung-hills, rubbish-heaps, etc. O. 4 × 6 × ½. Very suspicious.

**V. gloiocephala** Gill. (455).—Differs from 454 in its fuliginous, glutinous P. with striate margin, in the V. being circularly split and often fuscous, and in the G. being slightly toothed; odour strong. On the ground. O. $4\frac{1}{2}\times7\times\frac{1}{2}$. Edible.

**V. parvula** Quél. (457).—Wholly white. P. plano-convex, slightly viscid, then silky, shining; S. subbulbous, equal; V. membranous, sheathing, regularly 3–4-lobed. Woods and pastures. C. $1\times1\frac{1}{4}\times\frac{1}{8}$. Poisonous.

## XIII. ANNULARIA Gill.

(Latin *annulus*, a ring.)

*Annularia* agrees in structure with *Lepiota* and *Psalliota*, but has pink spores. The cap is fleshy, the stem fibrous, fleshy, fistulose, and provided with a membranous ring, and the gills are free. Terrestrial: one British species.

**A. lævis** Gill. (457 *a*). P. white with reddish or yellowish disc, convex, then plane, smooth at first, then minutely squamulose or fibrillose, margin often split and fimbriate with the remains of the veil; S. concolorous, slightly attenuate upwards, even, smooth, silky, bulbous; R. concolorous, somewhat distant, large, becoming free; G. white, then flesh-colour, free to distant, thin, somewhat crowded. Amongst grass. R. $3\frac{1}{4}\times6\times\frac{2}{3}$.

## XIV. PLUTEUS Quél.

(Latin *pluteus*, a movable pent-house—from the fancied resemblance of the cap to a turret or sentry-box.)

Fig. 17.—*Pluteus cervinus* Quél. (× ¼.)

*Pluteus* agrees in structure with *Hiatula*, *Pluteolus*, and *Pilosace*, but has pink spores. The cap is fleshy and regular, the stem fleshy to fibrous, and the gills free, rounded behind, usually white at first, then pink. Mostly growing on or close to tree-trunks. There are about fifteen British species.

43. **P. cervinus** Quél. (458). (Latin *cervus*, a deer—from the fawn-brown cap.)

Cap fuliginous, sometimes fawn-brown, fleshy, somewhat fragile, campanulate, then expanded, obtuse, covered with a continuous pellicle, which is toughly viscid in wet weather, but gradually breaks up into fibrils or squamules on the paler, often streaked cap; stem white, reticulated or striate with black fibrils, solid, firm, equal, often bulbous at the base, sometimes excentric; gills white, then flesh-colour, free, rounded behind, crowded, ventricose, somewhat crenulated; flesh white, soft.

On stumps, fallen trunks, saw-dust, etc. Common. Jan. to Dec. $6\times5\times1\frac{1}{2}$. Edible.

**P. chrysophæus** Quél. (470).—P. dark cinnamon or pale umber, often streaked with black, submembranous, convex, then expanded, margin striate; S. yellow, equal, striate, fibrillose; G. white, then flesh-colour. On twigs and stumps. C. $3\times2\times\frac{1}{4}$.

## XV. ENTOLOMA Quél.

(Greek *entos*, within, *loma* a fringe—from the potential rather than definite veil.)

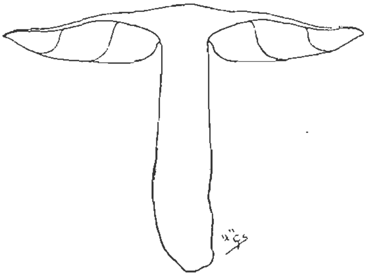

Fig. 18.- *Entoloma rhodopolium* Quél. (× ½.)

*Entoloma* agrees in structure and habit with *Tricholoma* and *Hebeloma*, and to a great extent with *Hypholoma*, but has pink spores. The cap is somewhat fleshy, with the margin at first incurved; the stem is fibrous or fleshy; the gills are sinuato-adnexed, sinuate, or adnate, often separating from the stem, at first white, then usually pink. All are terrestrial. Many are poisonous. There are about thirty British species.

i. Pileus glabrous, often viscid.

**E. lividum** Quél. (474). (Latin *lividus*, livid.)

Cap livid tan, becoming pale, fleshy, somewhat compact at the disc, convex, then plane, somewhat gibbous, dry, even, smooth, covered with a fissile pellicle; stem shining white, equal, substriate, apex pruinate; gills whitish, then flesh-colour, rounded, somewhat free, attenuated in front, distant; flesh white, brownish under the cuticle of the cap; smell of new meal; taste pleasant.

Woods and pastures. Frequent. April–Oct. 5×3×1. Poisonous.

**E. sinuatum** Quél. (473).—Differs from 474 in having a whitish P., which becomes somewhat yellowish with a repand margin, in its fibrillose then smooth S., in its yellowish-rufescent, emarginate, crowded G., and in its strong smell like burnt sugar. Woods. C. 7×5×1. Poisonous.

**E. placenta** Quél. (477).- P. brown, convex, then flattened, umbonate, moist when damp; S. concolorous, equal, fibrilloso-striate; G. whitish, then pallid flesh-colour, crowded, rather thick; taste becoming acrid. Hedge-rows etc. R. 2¼×3×¼. Doubtful.

**E. ardosiacum** Quél. (481). -P. steel-blue, shaded greenish, brown, or purplish, blackish when young, grey when older, campanulato-convex; S. steel-blue: G. white or grey, then flesh-colour, broad, ventricose, edge uneven; flesh white, bluish under cuticle of P. Moist meadows. F. 4×4×¼. Suspicious.

**E. ameides** Sacc. (483). P. pale reddish grey, irregular, broadly subumbonate, centre polished, margin white flocculent, becoming smooth and silky shining: S. paler, compressed, striate, fibrillose, apex flocculose, base villose; G. greyish, then flesh-colour, distant, wrinkled; odour at first unpleasant. Pastures. F. 2×2¼×½. Doubtful.

**E. fertile** Gill. (485). (Latin *fertilis*, fruitful.)

Cap pinkish buff, fleshy, obtuse, dry, pulverulento-squamulose; stem paler than the cap, firm, fibrillose, subsquamulose, subcompressed, base subbulbous; gills flesh-colour, adnexed, nearly free; flesh white; smell of new meal.

Woods. Rare. Aug.–Sept. 6×4×1. Poisonous.

ii. Pileus dry, flocculose, somewhat mealy.

**E. jubatum** Karst. (486).—P. mouse-colour, expanded, umbonate, floccoso-scaly, or fibrillose; S. concolorous, fleshy fibrous, covered with fuliginous fibrils; G. dark fuliginous, then purple-fuliginous, crowded, ventricose. Old pastures etc. C. $3\times4\times\frac{1}{4}$. Suspicious.

**E. sericellum** Quél. (489) (*Leptonia*).—P. white, then yellowish white, convex, then plane, obtuse, silky, becoming smooth or squamulose, margin floccose, inflexed at first; S. white, becoming paler and polished, subfistulose, waxy, fibrillose; G. white, then flesh-colour, very broad, distant. Woods. F. $1\times1\frac{3}{4}\times\frac{1}{16}$. Suspicious.

iii. Pileus thin, hygrophanous, rather silky when dry, often irregular and repand.

**E. clypeatum** Quél. (491).—P. lurid when moist, grey and variegated or darker when dry, campanulate, then flattened; S. whitish, becoming cinereous, wholly fibrous, longitudinally fibrillose, apex pulverulent; G. whitish or dingy, becoming red pulverulent with the spores, rounded, adnexed, ventricose, edge serrulate; flesh dark; solitary or cæspitose. Woods etc. C. $3\frac{1}{4}\times4\frac{3}{4}\times\frac{5}{8}$. Edible.

**E. rhodopolium** Quél. (493).—P. varying pale to dark fuscous, livid brown to purplish brown, campanulate, then expanded, subumbonate, fibrillose when young, margin bent inwards; S. substriate, apex white pruinose; G. white, then rose, adnate, flexuose; smell often of meal. Woods. C. $2\times4\times\frac{1}{4}$. Doubtful.

**E. pluteoides** Karst. (494).—P. whitish grey, becoming dingy yellowish when dry, scissile, slightly fibrillose at first; S. white, becoming yellow when touched, cuticle white subtomentose, base swollen and villose; G. white, then flesh-colour; flesh dark. On fir-stumps. R. $2\times4\times\frac{1}{4}$. Doubtful.

**E. costatum** Gill. (497) is distinguished by its G. being undulate and transversely veined with raised ribs. P. fuscous, livid, or greyish (shining black when sun-scorched); S. grey, substriate, apex white, mealy; G. pallid or greyish, then flesh-colour. Pastures etc. C. $2\frac{1}{2}\times2\times\frac{1}{4}$. Doubtful.

**E. sericeum** Quél. (498).—P. umber, convexo-plane, subrepand, margin involute and striate at first; S. grey fibrillose, shining; G. grey, then rufescent, equally attenuated from the S. to the margin; flesh umber; smell of meal. Pastures etc. C. $2\times2\times\frac{3}{16}$. Doubtful.

**E. nidorosum** Quél. (500).—P. fawn, cinereous, livid and silky shining when dry, convex, then expanded; S. whitish, apex white pruinose; G. pallid, then flesh-colour, sometimes undulato-flexuose; flesh white; odour usually strongly alkaline. Woods etc. C. $3\times4\times\frac{1}{4}$. Suspicious.

## XVI. CLITOPILUS Quél.

(Greek *klitos*, a declivity, *pilos*, a felt cap—from the shape.)

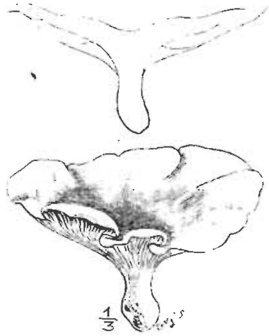


Fig. 19.—*Clitopilus prunulus.* (× ⅓.)

*Clitopilus* agrees in structure with *Clitocybe* and in part with *Flammula*, but the spores are pink. The cap is usually depressed or umbilicate, with the margin at first involute; the stem is fleshy or fibrous; the gills are decurrent or adnate, never sinuate nor seceding.

All the species grow on the ground, and most frequently have a mealy smell or taste. There are about twelve British species. None are known to be poisonous.

14. **C. prunulus** Quél. (503). (Latin *prunulus*, a little plum.)

Cap white or yellowish, rarely pale crimson, fleshy, compact, convex, then flattened, at length depressed and repand or unequal, delicately

pruinose, viscid when moist, often spotted or zoned, margin involute, thin, and mealy: stem white, solid, firm, ventricose or thickened upwards, pruinose or villose, often striate, cottony at the base; gills white, then flesh-white colour, deeply decurrent, attenuated at both ends; flesh white; smell and taste of meal.

Woods and pastures. Common. June to Nov. $3 \times 2\frac{3}{4} \times 1$. Edible.

**C. orcella** Quél. (504) is included in the description of 503; it is distinguished by the P. being viscid when moist, the S. being thickened upwards, the G. close, and the texture soft.

## XVII. LEPTONIA Quél.

(Greek *lepos*, slender.)

Fig. 20.—*Leptonia lampropus* Quél. (× ½.)

*Leptonia* agrees in structure with *Collybia*, *Naucoria*, *Psilocybe*, and *Panæolus*, but has pink spores. The cap is thin, umbilicate, or with a darker disc, the cuticle fibrillose or separating with darker scales, and the margin at first incurved; the stem is cartilaginous, glabrous, and sublustrous; the gills are adnexed or adnate, readily separating from their attachment to the stem. The species are small, brightly coloured, and abound in rainy weather on dry mossy pastures; *L. euchroa* Gill. (521) grows on trunks.

45. **L. chalybæa** Quél. (522). (Greek *chalups*, steel—from its steel-blue colour.)

Cap dark violaceous, steel-blue, or blackish blue, slightly fleshy, convex, subumbonate, flocculose, then squamulose; stem dark blue, cartilaginous, stuffed, smooth, slightly firm; gills light bluish grey with a paler edge, adnate, crowded, broad, ventricose.

Pastures. Common. July to Oct. $1\frac{1}{2} \times 2 \times \frac{1}{4}$.

**L. lampropus** Quél. (517). Differs from 522 in the colour of the P. and G. and in the thinner S. P. mouse-colour or steel-blue, then fuliginous grey, convex, then expanded and depressed, becoming more or less squamulose; S. blue-violet; G. whitish, then pale rose, adnate, then free. Heaths and pastures. C. $1\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{4}$.

**L. serrulata** Quél. (520).—Differs from 522 in its P. and S. being at first blackish blue, its S. black dotted at the apex and white woolly at the base, and its G. being grey flesh-colour with a black serrulated edge. Woods etc. C. $1\frac{3}{4} \times 2\frac{1}{2} \times \frac{1}{4}$.

**L. euchroa** Gill. (521).—Differs from 522 in its violaceous then purple fuliginous and squamuloso-fibrillose P., its concolorous fibrillosely mealy S. with a white base, its dark violaceous G. which become paler except at the edge, and its lignicolous habit. On stumps etc. of alder, hazel. F. $1\frac{3}{4} \times 2 \times \frac{1}{4}$.

**L. incana** Gill. (524).—P. olive- or bronzy-green, becoming greyish and somewhat silky when dry, submembranous, convex, then expanded, umbilicate, striate; S. concolorous or verdigris or greenish blue, fistulose, very cartilaginous; G. whitish green, then flesh-colour, distant; smell strong, like that of mice. Woods, pastures, etc. C. $1\frac{3}{4} \times 2 \times \frac{1}{16}$.

## XVIII. NOLANEA Quél.

(Latin *nola*, a small bell.)

*Nolanea* agrees in structure with *Mycena*, *Galera*, *Psathyra*, and *Psathyrella*, but has pink spores. The cap is submembranous, more or less campanulate, with the margin straight and at first adpressed to the cartilaginous stem; the gills are free, adnexed, or sinuate, never decurrent. Terrestrial, small, slender plants. There are about seventeen British species.

**N. pascua** Quél. (529).—*P. umber-brown and striate when moist, hoary or* becoming pale fawn and silky shining when dry, membranous, conico-campanulate, then expanded; S. faintly brownish, ochreous, or almost white, silky fibrous, striate; gills ashy-grey, almost free, crowded. Woods etc. C. 2×2½×⅛.

## XIX. ECCILIA Quél.

(Greek *ekkoiloo*, to hollow out—from the depressed cap.)

Fig. 21.—Section of *Eccilia acus* Sacc. (Nat. size.)

*Eccilia* agrees in structure with *Omphalia* and *Tubaria*, but has pink spores. The cap is submembranous and umbilicate or depressed, with the margin at first incurved; the stem is cartilaginous; the gills are decurrent. Small, slender plants growing on the ground, rarely on wood. There are about ten British species.

**E. carneogrisea** Gill. (545).—P. greyish flesh-colour, striate, delicately dotted, margin darker and micaceous; S. concolorous and shining, base white-tomentose; G. rosy, irregular, edge darker, adnato-decurrent, somewhat undulated, distant. Amongst fir-leaves. F. 2×1×⅛.

## XX. CLAUDOPUS Gill.

(Latin *claudus*, lame, Greek *pous*, a foot—from the dwarfed stem.)

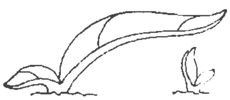

Fig. 22.—Sections of *Claudopus variabilis* Gill. (Nat. size.)

*Claudopus* agrees in structure and habit with *Pleurotus* and *Crepidotus*, but has pink spores. The cap is fleshy, excentric, lateral, or resupinate; the stem is lateral or wanting; the gills radiate from an excentric or lateral point, or are decurrent. The species are small, and grow on wood or on the ground. There are three British species.

**C. variabilis** Gill. (553). P. white, tomentose, resupinate, then reflexed, attached by a short incurved villose S., which is obliterated when the P. becomes reflexed; G. whitish, then rubiginous, at first concurrent in an excentric point, then reaching the base, broad, distant. On sticks etc. C. Diam. 1½ inch.

Sterile forms occur with white G.

SPORES BROWN.

## XXI. ACETABULARIA Mass.

(Latin *acetabulum*, a vinegar-cup—from the cup-like volva.)

*Acetabularia* agrees in structure with *Amanitopsis*, *Volvaria*, and *Chitonia*, but has ochraceous spores. In the single British species the cap is sulcate, the stem simple and volvate, and the gills adnexo-free.

**A. acetabulosa** Mass. (556).—P. salmon-colour, sienna-reddish, and white furfuraceous in the middle, convex, *margin striate*, denticulate, and splitting; S. whitish, mealy above, hollow; V. discoid, socket-like; G. pale brownish salmon with a lighter edge, subdistant, glandular. By the Thames at Millbank. R. $1 \times 2 \times \frac{1}{8}$.

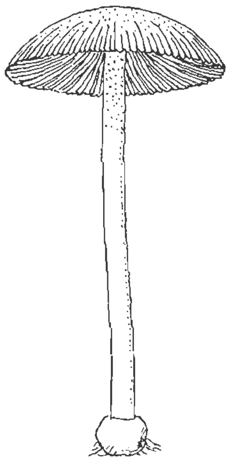

Fig. 23.—*Acetabularia acetabulosa* Mass. (Nat. size.)

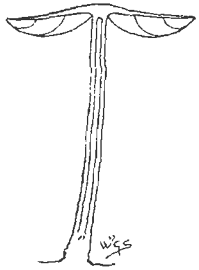

Fig. 24.—Section of *Pluteolus reticulatus* Gill. ($\times \frac{1}{2}$.)

## XXII. PLUTEOLUS Gill.

(Diminutive of *Pluteus.*)

*Pluteolus* agrees with *Hiatula*, *Pluteus*, and *Pilosace*, but the spores are ochraceous or ferruginous. The cap is fleshy, very thin, viscid, with a striate margin, which is straight at first, then adpressed to the fistulose cartilaginous stem; the gills are rounded, free. Growing on wood. There are three British species.

**P. reticulatus** Gill. (567).—P. violaceous, varying fuscous and livid grey, campanulate, then expanded, umbonate, subrepand, viscid at first and covered with a network of anastomosing veins, becoming even or slightly pitted, margin substriate; S. white, equal, fibrillose, apex mealy; G. dingy cinnamon, ventricose, crowded. On wood. O. $2 \times 2\frac{1}{4} \times \frac{1}{8}$.

## XXIII. PHOLIOTA, Quél.

(Greek *pholis*, a scale—from the scaly cap.)

Fig. 25.—*Pholiota squarrosa* Quél. (×¼.)

*Pholiota* agrees with *Armillaria* and *Stropharia* in structure, but has brown spores. The cap is fleshy and may be viscid or dry, scaly or naked; the stem is provided with a spreading, persistent, membranous ring; the gills are usually adnate, becoming emarginate or decurrent by a tooth, sometimes adnexed, at first pale or tawny, then usually becoming dark fuscous. Growing on wood or on the ground. There are about forty British species. None are known to be poisonous. (The terrestrial species have been separated as a separate genus, *Togaria*, by W. G. Smith.)

i. Growing on stumps, branches, etc.; mostly cæspitose.

46. **P. aurivella** Quél. (577). (Latin *aurum*, gold, *vellus*, fleece.)

Cap yellow or ferruginous yellow, with darker, adpressed, spot-like scales, fleshy, campanulate, then convex, compact at the disc, gibbous when expanded, moist, margin involute and floccoso-scaly when young; stem yellowish, clothed with adpressed, floccoso-fibrillose, fuscous-ferruginous scales up to the ring, at length naked, stuffed, fibrillose, equal, somewhat rooting; ring silky, somewhat membranous, superior; gills whitish, then straw-coloured, finally rusty brown or somewhat fuscous, sinuato-adnexed, broad, crowded; flesh white, becoming yellowish.

Cæspitose or solitary on old stumps. Uncommon. Sept. to Nov. $5 \times 4 \times \frac{1}{2}$.

47. **P. squarrosa** Quél. (578). (Latin *squarrosus*, rough.)

Cap saffron-ferruginous or ochraceous, squarrose with innate, crowded, revolute, darker to fuscous, persistent scales, fleshy, campanulato-convex, then flattened, obtusely umbonate or gibbous, dry; stem concolorous, squarrose up to the ring with crowded, revolute, darker scales, stuffed, attenuated downwards; ring concolorous with the scales, fibrillose, laciniate, superior; gills pallid-olivaceous, then ferruginous, adnate with a decurrent tooth, crowded, narrow; flesh light yellow; smell heavy, disagreeable. $4 \times 4\frac{1}{2} \times \frac{3}{4}$. Edible.

**P. subsquarrosa** Quél. (579).—Differs from 578 in the reddish-brown P. being viscid and floccosely scaly, the ill-defined R., the G. at first yellow and emarginato-free, and the absence of smell. On fir stumps. O. $2 \times 2\frac{3}{4} \times \frac{1}{4}$.

18. **P. spectabilis** Gill. (580). (Latin, *spectabilis*, notable.)

Cap tawny or golden yellow, becoming paler, fleshy, compact, hemispherical, obtuse, dry, shining, torn into adpressed, innate, pilose squamules, continued into the veil at the inflexed margin: stem sulphur-yellow, hard, more or less ventricose, and extended into a fusiform root, sheathed with the veil, smooth, shining, or squamulose, mealy above the ring; ring yellowish, becoming discoloured, inferior, persistent, spreading; gills yellow, then rusty brown, adnate, usually with a small decurrent tooth, narrow, very crowded; flesh sulphur-yellow, reddening when touched; smell pleasant; taste bitter, aromatic.

Cæspitose on stumps. Common. Aug. to Dec. $6 \times 6 \times 1$.

According to Zopf the yellow colour of all parts of the plant is due to a resin acid, which is present as a hyphal cell content.

**P. radicosa** Quél. (569).– P. clay-colour, then spotted rufous, convexo-plane, viscid: S. white, thickened and fusiform at the base, concentrically scaly below the ring, scales becoming rufous, apex mealy: R. white, membranous, distant, scaly; G. pallid, then rufescent ferruginous, adnato-toothed, or rounded, very crowded: smell like Cherry-laurel. Stumps etc. F. $4\frac{1}{2} \times 11 \times \frac{3}{4}$. Edible.

**P. ægerita** Quél. (573).– P. tawny, becoming pale towards the margin, convexo-plane, rivuloso-wrinkled, slightly viscid when moist, silky when dry, disc often areolately cracked, margin incurved and scalloped: S. white, becoming stained yellow, fibrillose, often striate; R. white, membranous, large, superior, reflexed; G. pallid, then fuscous, adnate with a tooth. Cæspitose on elm stumps and poplar. C. $4 \times 5 \times \frac{1}{4}$. Edible.

The Greeks and Romans apparently had methods of growing this species. According to Dioscorides the method was to scatter small pieces of poplar-bark over dunged places.

ii. Growing on the ground (*Togaria* W. G. Sm.).

**P. aurea** Gill. (557). Entirely golden tawny. P. convex, velvety, then squamulose: S. becoming pale, striate and ferruginous scurfy below the R., apex flocculose: R. membranous, erect, then spreading, flocculose, and ferruginous furfuraceous below, laciniate: G. pallid ferruginous, adnexo-free, connected by veins. Ground etc. O. $11 \times 12 \times 2$.

**P. caperata** Gill. (558) (*Rozites*). –P. deep yellow, campanulato-expanded, covered with the floccosely mealy veil, which is squamulose and fugacious towards the thin, lacunoso-wrinkled, sulcate, splitting margin. S. white, then tinged yellow, striate, fibrillose, universal veil often in the form of a volva, squamulose above the R.; R. white, becoming yellowish, membranous, striate, distant; G. clay-cinnamon, crowded, thin, denticulate. Woods. F. $4 \times 4\frac{1}{2} \times \frac{3}{4}$. Edible.

**P. terrigena** Karst. (559). –P. dingy yellow, convex, silky fibrillose, scaly towards margin: S. concolorous, clad with floccose squarrose squamules, which become ferruginous: R. thin, torn; G. pallid light yellow, then olivaceous ferruginous, adnate with a decurrent tooth. Woods etc. F. $2\frac{1}{2} \times 2\frac{3}{4} \times \frac{1}{4}$.

**P. erebia** Gill. (560).– P. dark ferruginous brown or umber, becoming paler ochraceous clay when dry, convex, then flattened, subviscid, margin striate when dry; S. fuliginous, becoming pale, fibrilloso-striate: R. white, becoming discoloured, sulcate, superior: G. pallid, then dingy cinnamon, adnate, subdistant; flesh pale brownish. Woods etc. F. $2 \times 2\frac{3}{4} \times \frac{1}{4}$. Edible.

**P. togularis** Quél. (563).– P. pallid ochraceous, disc darker, campanulato-expanded, sometimes striate: S. whitish, becoming fuscous at the thickened base, fibrillosely striate, apex mealy: R. white, membranous, median, spreading, reflexed, striate above; G. yellow, then pallid ferruginous, adnate or adnexed. Woods etc. F. $2 \times 3 \times \frac{3}{16}$.

**P. præcox** Quél. (566).—P. whitish, then tan, convexo-plane, fleshy, soft; S. white, becoming yellowish, at first floccosely mealy, base white-floccose; R. whitish membranous, entire, reflexed, striate above; G. whitish, then rust-colour, rounded, adnexed; taste and smell strong. Woods etc. C. 3×4×¼. Edible.

**P. dura** Quél. (565).—Differs from 566 in the P. being tawny tan-colour, then fuscous, compact, and becoming cracked, the yellowish S. being hard, silky, even, longitudinally cracked when dry, and with fibrillose rootlets at the base, the small R. and the white then livid or fuscous ferruginous G. adnate with a decurrent tooth, and the bitter taste. Fields etc. F. 3×3¼×⅝.

## XXIV. INOCYBE Quél.

(Greek *is, inos*, a fibre, *kube* head—from the fibrous cap.)

Fig. 26. *Inocybe lanuginosa* Quél. (×½.)

The cap in all species is innately silky, fibrillose, or fibrilloso-scaly, in a few species becoming smooth or viscid; the cuticle continues to the stem as a more or less evanescent, fibrillose cortina; the stem is scaly, fibrillose, or smooth, simple or imperfectly squarroso-annulate; the gills are usually sinuate, sometimes adnexed, adnate, or decurrent, at first pale, then changing colour, never becoming cinnamon pulverulent. The species are small and, almost without exception, terrestrial. No species are known to be edible, some are known definitely to be poisonous. There are over fifty British species.

*Inocybe* is intermediate between *Hebeloma* and *Cortinarius*, differing from the former in the usually non-viscid cap and from the latter in the absence of a typical cortina and in the colour of the spores. (The species with angular, irregular, nodose, verrucose, and echinulate spores are often placed in a separate genus, *Astrosporina*. Schroet.)

50. **I. scabra** Gill. (610). (Latin *scaber*, rough.)

Cap becoming pale fuliginous or pale tan, variegated with adpressed, darker, spot-like, fibrous scales, fleshy, somewhat compact, conical, then convex; stem whitish, firm, equal, cuticle cartilaginous, silky fibrillose; gills whitish, then dusky, slightly adnexed, thin, somewhat crowded; flesh white.

Coniferous and mixed woods. Frequent. June to July. 1¾×1¾×¼.

**I. pyriodora** Quél. (608).—P. reddish when young, then pale ochraceous, disc darker, campanulate, disc scaly, otherwise fibrillose, margin often bent in and lacerate; S. pallid, often tinged reddish, often curved, fibrillose, apex white, mealy; G. whitish, then fuliginous with whitish edge, adnate, then subemarginate, crowded; flesh becoming reddish; odour of ripe pears. Woods. C. 3×3¾×¼.

51. **I. rimosa** Quél. (627). (Latin *rimosus*, full of cracks.)

Cap yellowish, varying rufescent and date-brown, fleshy, conico-campanulate, obtuse, then flattened, and finally reflexed, subumbonate, or obtuse, subfibrillose, longitudinally cracked, disc sometimes even,

sometimes cracked in a tesselated manner; stem whitish, becoming yellow or fuscous, firm, thickened and fibrillose at the base, apex mealy; gills whitish, then fuscous, and finally ferruginous, free, or slightly adnexed, very attenuate behind, subventricose, edge serrulate and pallid; smell earthy.

Woods and open ground. Common. June to Nov. $3 \times 3\frac{1}{4} \times \frac{1}{4}$.

**I. fastigiata** Quél. (624).—Differs from 627 in its more fibrillose, acutely umbonate P. with the margin sometimes lobed, in its S. being pallid at first, and its G. being yellow, then olivaceous, with an even edge of the same colour. Woods etc. F. $3\frac{3}{4} \times 5 \times \frac{1}{4}$.

**I. cervicolor** Quél. (617 *a*).—P. pale brown or fawn covered with brown recurved fibrils, campanulate, thin: S. whitish, fibrillose, with brown recurved filaments throughout its length, firm, flexuose: G. cream-colour, then rusty brown, with white denticulate edge, emarginate, ventricose, distant: flesh white, tinged purplish; smell strong and unpleasant. Woods etc. C. $1 \times 3 \times \frac{1}{4}$.

**I. geophylla** Quél. (640).—P. white, sometimes tinged yellow when old, somewhat fleshy, conical, then expanded, umbonate, silky, then fibrillose, often cracking; S. white, base slightly thickened, satiny, apex white mealy: G. whitish, then clay fuscous, and umber, almost free, rather broad, ventricose, crowded; smell earthy. Woods etc. C. $\frac{3}{4} \times 2 \times \frac{1}{8}$.

Var. *lilacina* Fr. has a violet-coloured P. with a yellow umbo and pale violet S. with yellow base.

## XXV. HEBELOMA Quél.

(Greek *hebe*, youth, *loma*, a fringe—from the fringe-like veil in young specimens of certain species.)

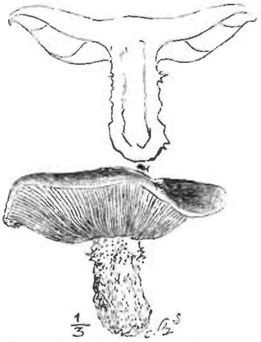

Fig. 27.—*Hebeloma fastibile* Quél. (× ⅓.)

*Hebeloma* agrees in structure with *Tricholoma*, *Entoloma*, and *Hypholoma*, but the spores are clay-colour. The cap is smooth to subviscid, with the margin at first incurved; the stem is fleshy or fibrous, mealy at the apex, and sometimes shining, showing slight traces of a veil or ring; the gills are sinuato-adnate. All the species are terrestrial and usually strong-smelling. There are about thirty British species.

52. **H. fastibile** Quél. (648). (Latin *fastibilis*, disagreeable.)

Cap pale yellowish tan or becoming pale, compactly fleshy, convexo-plane, obtuse, subrepand, even, smooth, margin involute and pubescent; stem white or pallid, solid, fleshy-fibrous, striate, subbulbose, often twisted, white, silky, and fibrillose; cortina white, silky, occasionally in the form of a ring; gills at first whitish, then dingy clay-colour, edge whitish, very emarginate, rather broad, subdistant, exuding drops in wet weather: flesh white; smell fœtid; taste of radish, bitterish; *somewhat cæspitose.*

Woods. Common. July to Nov. $4 \times 2\frac{1}{2} \times \frac{3}{4}$. Suspicious.

*H. fastibile* is sometimes exposed for sale in markets as the Mushroom ; it may make its appearance on mushroom-beds and oust the mushroom, from which it differs in its smell, absence of ring, and colour of gills and spores.

**H. glutinosum** Sacc. (649).—P. yellow white, disc darker, plane, obtuse, glutinous, *white squamulose* : S. *whitish, becoming ferruginous downwards*, subbulbose, white squamulose, base strigose : G. light yellowish, then clay-cinnamon : taste and odour mild. Woods. C. $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$.

**H. mesophæum** Quél. (655). P. pale yellowish or becoming pale, disc date-brown, plane, subgibbous, viscid : S. whitish, then ferruginous, base becoming fuscous : Co. thin, fugacious : smell slight, taste acrid. Coniferous woods. C. $2 \times 3 \times \frac{1}{4}$.

53. **H. crustuliniforme** Quél. (659). (Latin *crustulum*, a small pie—from the shape of the cap.)

Cap pale whitish tan, with pale yellowish or brick-coloured disc, fleshy, convexo-plane, obtuse, or slightly gibbous with an obtuse umbo, subrepand, even, at first slightly viscid ; stem whitish, equal or subbulbous, stuffed, then hollow, firm, apex white squamulose ; gills whitish, then clay-colour, at length date-brown, rounded-adnexed, crowded, narrow, linear, thin, with guttate unequal edge, exuding drops in wet weather, spotted when dry ; odour strong of radish, fœtid ; taste acrid.

Woods etc. Common. Aug. to Nov. Suspicious.

**H. sinapizans** Gill. (658).—P. clay-colour, disc yellowish, convexo-plane, very obtuse, repand, often excentric, subviscid at first : S. white, rigid, fibrilloso-striate : G. clay-cinnamon, deeply emarginate : *flesh white* : smell *strong of radish*. Woods. O. $5\frac{1}{2} \times 3 \times \frac{1}{2}$. Suspicious.

## XXVI. FLAMMULA Quél.

(Latin *flamma*, a flame—from the frequent bright colours.)

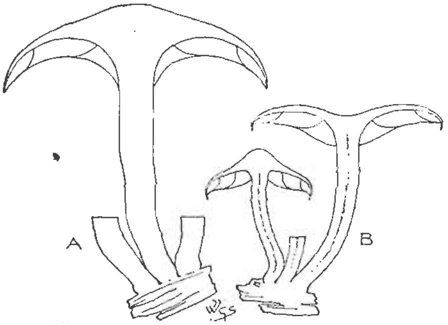

Fig. 28.—A, section of *Flammula gymnopodia* Quél. B, ditto *F. flavida* Quél. ($\times \frac{1}{2}$.)

Some species of this genus agree in structure with *Clitocybe* and *Clitopilus* ; those growing on wood approach *Pholiota* and agree with *Armillaria*, and in part with *Hebeloma* and *Stropharia*. The cap is fleshy and the margin involute at first ; the stem is sometimes subannulate, and is fleshy-fibrous ; the gills are decurrent or adnate, but not sinuate, usually at first whitish, clay-colour, or yellowish, then coloured by the spores. The species usually grow on wood, though some are terrestrial. There are about thirty British species.

**F. gummosa** Quél. (683).—P. light yellowish or olive shaded, paler at the margin, flat, obtuse, depressed, covered with a separable, viscid pellicle, floccosely scaly, then smooth; S. ferruginous, rubiginous at the base, paler upwards, silky fibrillose; G. light yellowish, then crimson, adnate, crowded. Old stumps. O. $2\frac{3}{4} \times 3 \times \frac{1}{4}$. Edible.

**F. carbonaria** Quél. (685).—P. tawny, plane, sometimes depressed, viscid, margin incurved and often floccosely fimbriate: S. pallid, often blackish at the base, rigid, fibrillosely squamulose, the mycelium often forming a pseudo-bulb with the soil; Co. fibrillose, fugacious; G. clay, then fuscous-clay colour, adnate, rather broad, crowded; flesh yellowish. Charcoal-heaps and burnt ground. C. $2\frac{1}{2} \times \frac{3}{4} \times \frac{1}{4}$.

**F. flavida** Quél. (690). P. bright yellow, convex, then expanded, obtuse, moist: S. concolorous, becoming ferruginous towards the base, subflexuose, fibrillose: Co. white, adhering to margin of P.; G. whitish, then light yellow, finally tawny ferruginous, adnate. Cæspitose on stumps. C. $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{4}$.

**F. sapinea** Quél. (696). P. golden tawny, opaque at the disc, paler and shining towards the margin, hemispherical, then convexo-plane, very obtuse, covered with thin, squamulose, adpressed floccules, often rimosely scaly, marginate, appendiculate with the yellowish Co.: S. brownish, becoming paler, turning fuscous when bruised, sulcate or lacunose: G. golden, then tawny cinnamon, broad, crowded. Coniferous stumps etc. C. $2\frac{3}{4} \times 3\frac{1}{2} \times \frac{1}{4}$.

**F. ochrochlora** Karst. (700). P. straw-colour, becoming greenish, convex, then plane, subumbonate, dry, silky, squamulose; S. yellowish, becoming ferruginous towards the base, squamulose and white floccose; Co. white, manifest; G. whitish, then greenish, finally olivaceous, adnate, crowded. Cæspitose on old stumps etc. C. $2 \times 3 \times \frac{1}{4}$.

## XXVII. NAUCORIA Quél.

(Latin *naucum*, a trifle—from the almost obsolete veil.)

*Naucoria* agrees in structure with *Collybia*, *Leptonia*, and *Psilocybe*, but has ferruginous spores. Cap more or less fleshy, convex, or conical, becoming flat, margin at first incurved and usually even; the stem is subcartilaginous, hollow, or stuffed; the gills are free or adnate, never decurrent; growing on the ground or epiphytic, sometimes rooting. The species are usually small in size and brown in colour. The genus is distinguished from *Flammula* by its subcartilaginous, not fibrous, stem. There are about fifty British species.

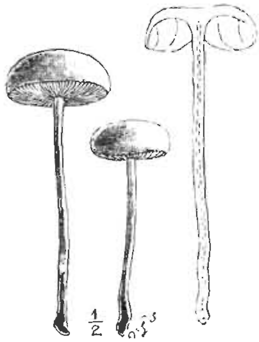

Fig. 29.—*Naucoria semiorbicularis* Quél. (× ½.)

54. **N. horizontalis** Quél. (713). (Latin *horizontalis*, horizontal.)

Entirely pale cinnamon. Cap slightly fleshy, convexo-plane, obtuse, even; stem solid, very short, incurved, naked; gills rounded, free, broad, plane.

Branches, logs, etc., of elm. Rare. Dec. $\frac{3}{4} \times \frac{1}{2} \times \frac{1}{8}$.

**N. Cucumis** Gill. (709) (*Nolanea pisciodora* Gill. 534, *N. nigripes* Gill. 535, *N. picea* Gill. 538). P. tawny cinnamon to black, becoming paler towards the margin, paler when dry, campanulato-convex, pruinose, margin incurved and often striate when moist; S. date-brown to smoky black, pruinose, velvety, tough, apex paler, base white floccose; flesh concolorous; smell strong of fish or cucumber. Woods. C. $2\frac{1}{4} \times 2\frac{1}{2} \times \frac{3}{16}$.

**N. melinoides** Quél. (720). P. tawny, ochraceous when dry, convexo-plane, obtuse, or gibbous, margin striate when old; S. concolorous, base paler, apex white pruinose; G. tawny or light yellow ochraceous, adnate, ventricose, crowded, edge often denticulate; flesh yellowish. Heaths, pastures, etc. C. $1 \times 1\frac{3}{4} \times \frac{1}{16}$.

**N. pediades** Quél. (731). P. yellow or somewhat buff, plane, obtuse, dry, smooth, at length rimoso-rivulose; S. concolorous, stuffed with a pith, base bulbous owing to the compacted mycelium, slightly silky, becoming even; G. dull cinnamon, subdistant. Pastures. C. $1\frac{1}{2} \times 2\frac{3}{4} \times \frac{1}{16}$.

**N. semiorbicularis** Quél. (733).—P. tawny ferruginous to ochraceous, hemispherical, smooth, viscid, corrugate when dry; S. ochraceous, becoming pallid ferruginous, shining, cartilaginous, smooth, with an internal, separable, fistulose pith; G. pallid, then ferruginous, usually adnate. Pastures etc. C. $1 \times 2\frac{3}{4} \times \frac{1}{8}$

**N. escharoides** Quél. (744).—P. tan, then whitish, disc becoming fuscous conico-convex, soon flattened, obtuse, flocculoso-furfuraceous; S. pallid to fuscous, adpressedly fibrillose, then smooth, apex pruinose; G. somewhat cinnamon, often with a pale floccose edge, adnate with a tooth or emarginato-free. Under alders. C. $1 \times 1\frac{1}{2} \times \frac{1}{16}$.

## XXVIII. GALERA Quél.

(Latin *galerus*, a cap.)

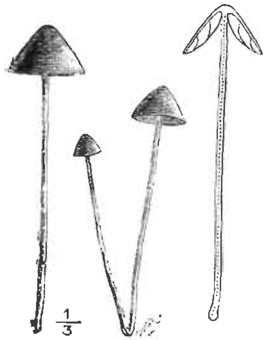

Fig. 30.—*Galera tenera* Quél. (× ⅓.)

*Galera* agrees in structure with *Mycena*, *Nolanea*, and *Psathyra*, but the spores are ochreous-ferruginous. Cap thin, conical, campanulate, or oval, with the striate margin at first straight and adpressed to the subcartilaginous, fistulose stem; the gills are either narrowly adnate or adnexed to the stem within the cone of the cap; generally small in size, slender, and fragile, growing on moss or on the ground. There are about twenty British species.

55. **G. tenera** Quél. (748). (Latin *tener*, tender.)

Cap pallid ferruginous and substriate when moist, becoming pale and even when dry, conico-campanulate, hygrophanous, submembranous, opaque, somewhat atomate; stem concolorous, fistulose, fragile, equal, or thickened downwards, tense and straight, somewhat shining, striate above; gills cinnamon, adnate in the top of cone, somewhat crowded, linear. Variable in size.

In pastures and grass. Common. $1\frac{1}{4} \times 4\frac{1}{2} \times \frac{1}{8}$.

**G. hypnorum** Quél. (757).—Differs from 748 in the campanulate and somewhat papillate P., the more flexile S. pruinose at the apex, and the distant and broader G. Among moss. C. $1 \times 4 \times \frac{1}{16}$.

## XXIX. TUBARIA Gill.

(Latin *tuba*, a trumpet—from the shape of typical species.)

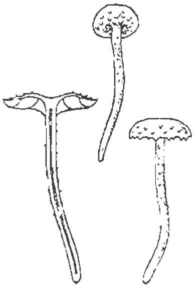

Fig. 31.—*Tubaria furfuracea* Gill. ($\times \frac{1}{2}$.)

*Tubaria* is characterised by the decurrent gills and cartilaginous stem, thus differing from *Flammula*, which has a fibrous stem, and agreeing with *Omphalia* and *Eccilia* in structure; cap submembranaceous, sometimes umbilicate or depressed, margin striate; stem fistulose, sometimes imperfectly annulate; G. subdecurrent, broadest behind, and somewhat triangular. There are about ten British species.

**T. furfuracea** Gill. (763).—P. cinnamon to whitish tan, flat, umbilicate, margin substriate when moist, and appendiculate with the white squamulose veil; S. concolorous, floccose, base villous; G. bright cinnamon or clay, subdecurrent. Woods etc. C. $1\frac{1}{4} \times 1\frac{3}{4} \times \frac{1}{8}$.

## XXX. CREPIDOTUS Quél.

(Greek, *krepis*, a slipper—from the shape of some species.)

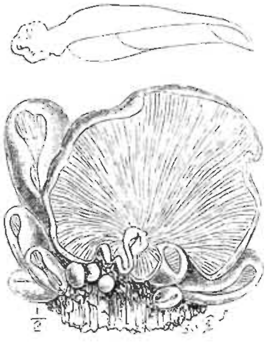

Fig. 32.—*Crepidotus mollis* Quél. ($\times \frac{1}{2}$.)

Cap excentric, lateral, or resupinate, commonly thin, and with soft flesh; stem lateral, simple, or absent; gills more or less decurrent, reaching the S., or axis, or radiating from an excentric point. Agreeing in shape with *Pleurotus* and *Claudopus*, but with ferruginous spores. Mostly small, growing on decaying stumps and branches; a few grow on leaves, moss, etc. There are about fifteen British species.

56. **C. mollis** Quél. (Latin *mollis*, soft.) (774.)

Cap pallid, then becoming hoary, at length with rufous spots from the shed spores, gelatinous-fleshy, convexo-plane, obvate, or reniform, undulated and lobed when larger, flaccid, even, smooth, dimidiate, subsessile, or extended behind with a short ($\frac{1}{2}$ in.) strigose stem, often imbricated; gills whitish grey, then pale cinnamon, commonly decurrent to the base, linear, crowded; flesh watery, whitish; taste mild.

On stumps, twigs, branches, saw-dust, squared wood. Common. May to Dec. $2\frac{3}{4}$ in. diam. Edible.

Spores purple.

## XXXI. CHITONIA Karst.

(Greek *chiton*, a tunic—from the veil.)

*Chitonia* agrees in structure with *Amanitopsis*, *Volvaria*, and *Acetabularia*, but has fuscous-purple spores. The cap is subfleshy; the stem hollow and volvate; the gills free. One (introduced) British species.

**C. rubriceps** Sacc. (786). P. brick-red, expanded, umbonate, smooth, even; S. dull pale reddish ochreous, paler below, and rooting; V. large, sheathing, saccate, edge torn; G. purplish brown, subcrowded. Soil in an aroid house. R. $1\frac{3}{4} \times 3\frac{1}{2} \times \frac{1}{2}$.

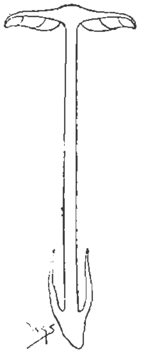

Fig. 33.—Section of *Chitonia rubriceps* Sacc. (× ½.)

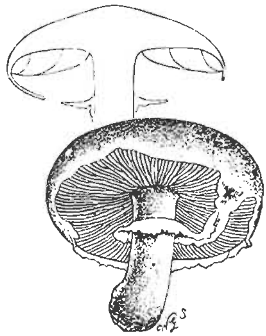

Fig. 34.—*Psalliota campestris* Quél. (× ⅓.)

## XXXII. PSALLIOTA Quél.

(Greek *psalion*, a ring—from the annulus.)

*Psalliota* agrees in structure with *Lepiota* and *Annularia*. The cap is fleshy; the stem is fibrous fleshy and provided with a ring; the gills are free, whitish at first, then frequently pink, and at length deep purple-brown. All species are terrestrial. There are about twenty British species—most, if not all of which are edible.

57. **P. arvensis** Quél. (789). (Latin *arvensis*, belonging to cultivated fields.) Horse Mushroom.

Cap whitish, becoming stained with yellow, fleshy, globoso-campanulate, then flattened, obtuse, flocculoso-mealy when young, then slightly silky or squamulose, dry; stem white, often stained with yellow, hollow with a lax floccose pith, stout, thickened at the base, obsoletely marginato-bulbous when young, even, smooth;

ring white, superior, large, spreading, or pendulous, appearing double, with the upper portion membranous and uniform, and the lower one thicker and shorter, more or less free at the circumference and radiately split, often appendiculate at the margin of the cap: gills white, at length reddish fuscous, free, approximate, ventricose, broader in front, always arid; flesh white, or tinged with yellow, compact, firm, juicy, at length softer.

In meadows etc., often forming rings. $8 \times 4 \times 1\frac{1}{4}$. Edible.

The cultivated mushrooms of gardeners often belong to this species. When young it is delicious, but becomes tough and dry with age. It makes a good ketchup. There are several named varieties, but probably most of them are mere growth-forms. They are described in the Guide to Mr. Worthington Smith's "Drawings of Field and Cultivated Mushrooms and Poisonous or Worthless Fungi often mistaken for Mushrooms."

**P. Bernardii** Quél.—P. white, the tomentose surface soon breaking up into thick, angular warts with ferruginous apices; S. white, reddish brown when old, base bulbous, apex striate; R. white, membranous, fugacious, upper surface striate: G. greyish flesh-colour, then blackish purple: flesh white, then tinged purple; smell unpleasant. Pastures near the sea. O. $8 \times 3 \times 1\frac{1}{4}$. Edible.

**P. elvensis** Henn. (788) is distinguished from 789 by its purplish-brown P. covered with large, pointed, somewhat revolute, darker scales, with a very obtuse warted margin, by its concolorous S. fibrillose below the concolorous R., by its brownish flesh-colour, then brownish-purple G., and by its flesh turning red then brownish. Under trees. O. $6\frac{1}{2} \times 5 \times 1\frac{1}{4}$. Edible.

**P. augusta** Quél. (787).—P. whitish, fuscous-citron, or dark straw colour, silky, then adpressedly squamulose with a tomentosely toothed margin; S. white, becoming yellowish, then brownish when bruised, attenuated upwards, flocculose immediately below the R.; R. white and smooth above, yellowish and flocculose below, very wide: G. pallid, then fuscous, attached to a broad collar, crowded; flesh whitish, becoming yellowish or brownish in the S.: odour of anise. Woods etc. O. Edible.

**P. perrara** Magn. (789 *a*).—Differs from 787 in the yellow P. covered with dense, imbricate, fulvous scales, in the whitish S. being covered below the R. with evanescent fulvous scales, in the G. being white, then pink, and finally fuscous, often very remote, and in the flesh of the S. becoming yellowish when broken. Oak woods. $5\frac{1}{2} \times 4 \times 1$. Edible.

**P. xanthoderma** W. G. Sm. (789 *b*) is distinguished by the P. and S. becoming yellow when touched and in the flesh becoming yellow, especially at the base of the S. and under the cuticle. P. white, then somewhat tawny, silky; S. white, silky, subbulbose: R. white, often stained yellow at the margin: G. white, then pink, grey, violet, or brownish: smell and taste somewhat fœtid. Woods etc. $3\frac{1}{2} \times 4 \times \frac{3}{4}$. Suspicious.

**P. flavescens** Gill.—Differs from 789 *b* in the satiny sheen of its P. and S., and in the absence of smell. S. white, becoming saffron-yellow at one side of the base, cylindrical; R. dingy white, exterior yellowish; G. pale pink, then brownish: flesh white, turning instantly bright saffron-yellow. Pastures and fir woods. F. $3\frac{1}{2} \times 4\frac{1}{2} \times \frac{1}{2}$. Suspicious.

58. **P. campestris** Quél. (792). (Latin *campester*, belonging to a plain.) Common Mushroom.

Cap varying from white to rufescent brownish, fleshy, at first flattened hemispherical, then flattened, obtuse, dry, silky, even, or

squamulose: stem white, stuffed, firm, short, bulbous when young, then somewhat equal, even, or squamulose; ring white, membranous, sometimes in the form of a cortina, median, spreading or reflexed, torn, often fugacious; gills whitish, soon flesh-colour, rose-salmon, or pink, then dark purplish brown, free, approximate, equally attenuated at both ends, crowded; flesh white, becoming reddish or sometimes fuscous, thick, soft; smell and taste pleasant.

Pastures etc. Common. May to Dec. $5 \times 3\frac{3}{4} \times 1$. Edible.

There are several named varieties, but many of these are doubtless growth-forms. It is of interest to note that the commonly cultivated form has only two spores on the basidium.

*P. campestris* is the Common Mushroom. The name mushroom is often confined to this species, *P. arvensis* being styled "horse-mushroom." By some, however, the name is used for all edible agarics, the remainder being lumped together as toadstools. The mushroom does not appear to have been especially favoured in classical times, and no reference has been found to any attempts then to cultivate it—in fact, apparently only *Pholiota ægerita* was so favoured (see p. 62). It is probable that the conspicuous character of the mycelium first led to the artificial cultivation of *P. campestris*. So far as can be ascertained, culture was first practised in France. Tournefort has left an account, written in 1707, of the methods then in vogue. The description shows that the methods employed were not very dissimilar from those of the present day. No special effort to obtain "spawn" is mentioned, however, the spores of the mushroom being regarded as being naturally in the horse-dung, of which the first beds were made. In this country "virgin spawn" is obtained from various places, such as old rich pastures where horses and oxen have been feeding. With experience, collectors become expert in recognising the mycelia of different fungi. That of the mushroom has a pleasing odour of fresh mushrooms with a suggestion of powdered almonds: the odour is largely lost in drying. As will be seen below, virgin spawn must be repeatedly gathered, so that it is quite impossible to hold that the commercially grown mushrom varieties have arisen during cultivation; they are either to be found growing naturally or are merely growth-forms.

*Bricks.*—The virgin spawn is used for inoculating "bricks." It has been found by experience that the same spawn cannot be continuously used for raising mushrooms with any success, and virgin spawn is therefore always used by growers for inoculating bricks. These are usually made from a wet mixture of stable-manure, cow-manure, and a small quantity of loam. There are different modes of preparing them, but hand-moulding is the commonest.

The moistened compost is pressed into moulds about $9 \times 6 \times 4$. The bricks are then dried on racks. While the bricks are still fairly moist, pieces of virgin spawn are inserted, one or two at each end, or the bricks are dried until they are but slightly moist throughout, then piled and a few pieces of virgin spawn placed between each pair of bricks in successive layers. By this means the brick becomes thoroughly permeated by spawn. The spawn in prepared bricks is often stated to be able to remain in a resting condition for several years, but under ordinary circumstances it deteriorates in a year and is unfit for commercial purposes.

*Compost.*—As a compost for growing mushrooms no substitute for stable-manure is known. The best results are obtained by using manure fresh from the stable. The most favourable manure is that of grain-fed animals, with a considerable amount of bedding-straw—rye bedding-straw is preferred in France. The manure is placed in piles not more than four feet high, and thoroughly wetted. This is to bring about fermentation, which, in ordinary conditions, takes about three weeks, the heap being kept moist and turned every three to five days; when saw-dust or shavings are present, fermentation takes longer. With adequate moisture supply a temperature of 140° to 150° F.

between the first three turnings may be considered advantageous. If sufficient water is not present the manure will "burn" easily, and will then require a much longer fermentation-period. The best results are obtained when the temperature remains above 120° for several days. During composting the manure should lose all objectionable odour, and the straw should become pliable, brown in colour, and with an oleaginous feel.

*Necessity for fermentation.* Duggar has shown that fermentation is not chemically essential by growing mycelium in sterilised manure, both fermented and unfermented, growth being as rapid and much more profuse in the latter. Fresh manure contains readily soluble and relatively unstable organic substances, which are usually the seat of abundant bacterial activity. During the first stages of fermentation the mushroom mycelium will not grow, even though the manure be in such small quantity that no noticeable rise in temperature occurs. Fermentation serves apparently to remove or transform rapidly fermentable products, and induces certain changes in the insoluble material and the straw whereby the mushroom mycelium is able to grow and to compete with the micro-organisms next involved: the mushroom gradually uses the soluble organic products as well as the necessary organic salts.

*Beds.* The compost is made into beds and somewhat compressed with a shovel, or firmed with a compressing board, to prevent its becoming loose and dry. Indoors the usual shape is the flat bed, which should be eight to ten inches deep after compression. Out-of-doors the ridge type is used, which is usually two feet at the base, a foot in height, and six inches across the top. In the latter case, a small amount of fresh manure is often placed below with the idea of maintaining a slight and fairly uniform heat. The compost must remain moist.

*Spawning.* When the temperature has declined to about 70° the bed is spawned. The brick is broken up into pieces about the size of a hen's egg, and one piece used for each square foot of bed-space; the piece is buried about one inch deep. Growth begins in about a week or ten days.

*Casing.* When the spawn is seen to be "running" satisfactorily, the bed is covered with an inch or more of fairly rich loam. French growers prefer calcareous soil, but any good garden loam or potting soil is satisfactory. The casing soil should be kept moist by repeatedly sprinkling. When mushrooms begin to appear, more moisture is given.

As at present cultivated, the most suitable temperature for the house is between 54° and 56°; a temperature continuously below 50° or above 65° is not commonly favourable. Under sterile conditions the mycelium grows well up to 85° if sufficient moisture be present the deleterious effect of too much heat is due to the beneficial effect on other organisms. Under favourable conditions a bed should begin to bear after from six to eight weeks, and continue to produce mushrooms for from two to four months. When the bed has ceased producing satisfactory fruit-bodies, the compost is excellent as garden manure.

The beds are often invaded by other fungi, e. g. *Xylaria pedunculata* (*Pyrenomycete*) sometimes destroys beds, and other common fungi are *Clitocybe dealbata*, *Clitopilus prunulus*, and *Hebeloma fastibile*. Where shavings are used in the compost, species of *Coprinus* frequently occur.

It is often stated that mushrooms should be grown in the dark. It is difficult to understand the reason for this statement, considering the normal habitat of the fungus; probably it is nothing more than the heating effect of sunlight passing through glass that is in question. For indoor culture any place which provides a suitable temperature and is free from draughts can be used. In the case of outdoor cultivation, shelter from cold winds is essential. Disused tunnels and caves are made use of to some extent in this country, but the caves (catacombs) under Paris and its environs are the main seat of the French mushroom industry. The buildings of Paris are constructed mainly of limestone, which has been mined under the city and its suburbs in such a way as to leave vast labyrinthine systems of caves. The caves are well ventilated by means of chimneys or chutes.

*Pure Cultures.*—It is extremely difficult to germinate mushroom spores: in fact, though many successful methods have been reported, the only one of which any details have been given is that of Ferguson, who found that the spores germinated readily if a piece of mycelium were present. This method has not been found practicable on a commercial scale. The necessity for gathering virgin spawn has, however, been eliminated by a method worked out by Duggar for the U.S.A. Department of Agriculture. This method is called the tissue-culture method, from the fact that pieces of mushroom tissue are used for starting the spawn. The method is an application on a commercial scale of the well-known fact that fungi can often be got to grow vegetatively in culture where spore germination cannot be obtained.

The materials or media and all the vessels employed must be sterilised, and all operations must be conducted in such a way that contamination is prevented. (Details of such methods are given in most text-books on bacteriology.) Large test-tubes or wide-mouthed bottles are used, and about two-thirds filled with manure or half-decayed leaves. The tubes are then sterilised. Small pieces of the internal tissue of the mushroom which has been chosen for propagation-purposes are then cut out with a sterile scapel and transferred to the tubes. It is best to use young specimens in which the veil is still intact. The tubes are then kept at a suitable temperature and, after a few days, growth is evident, and in about three weeks spreads to practically all parts of the medium in the tube. The contents may then be removed and used for spawning bricks.

One of the advantages of the tissue-culture method is that selection may be made, and any mushroom with desirable qualities used for spawn-making.

*Diseases of Mushrooms.* The best known disease of mushrooms is that caused by *Mycogone perniciosa* Magn., one of the Hyphomycetes. Mushrooms affected with this disease undergo hypertrophy: in certain cases, though the cap, stem, and gills are well defined, the cap is distorted and the stem and gills swollen: in others the cap is poorly developed or entirely lacking, and the stem is so swollen that the affected mushroom has the appearance of a puff-ball. The parasite appears to have three stages—a large-spored *Verticillium* stage, a *Mycogone* stage, and, finally, a small-spored *Verticillium* stage. The spawn is also affected. As a method of control, the spraying of the beds with a 2½ per cent. solution of lysol has been found efficacious, and formaldehyde-gas fumigation and proper sanitary measures effectively control the trouble.

There is also a bacterial disease of mushrooms caused by a species of *Pseudomonas*, *P. Tolaasi*. The cap shows irregular chestnut-brown spots, which spread rapidly, coalesce, and occasionally cover the whole cap. The patches become slightly depressed, dry up, and crack radially as the mushroom grows. Sulphur-fumigation of the beds previous to spawning is an efficient method of preventing the disease.

Trouble is also very frequently caused by mites, flies, dung-beetles, slugs, etc.

*Cultivation of other Fungi.*—The only other fungi grown on a commercial scale are the Japanese "Shiitake" (*Tricholoma Shiitake*) and its allies, although, under laboratory conditions, success has been achieved during recent years in growing from seventy to eighty species of Basidiomycetes by appropriate pure-culture methods, either from the spore or from the vegetative mycelium.

The method of cultivation of the Shiitake is several centuries old. The fungus occurs most luxuriously upon *Carpinus laxiflora* and *Quercus glandulifera*. Poles of these are cut and allowed to weather. Small holes are then bored into the wood and spawn, which is prepared by chipping and grinding infected wood of *Carpinus*, placed therein. The first fruit-bodies occur after about two years.

**P. pratensis** Quél. (791) is intermediate between *P. arvensis* and *P. campestris*. P. whitish, becoming cinereous, fleshy, ovoid, then expanded, silky, then rimosely squamulose, dry; S. white, equal, slightly incrassated at the base, firm, smooth; R. white, membranous, median, deciduous; G. cinereous, then fuscous, rounded behind, acutely attenuated in front; flesh white; smell and taste pleasant. Woods etc. O. 3½×3×½. Edible.

**P. sylvicola.** -Differs from *P. campestris* in its P. being shining white. almost smooth. with the margin often appendiculate with the remains of the R.. the concolorous S. with subbulbous base. the large reflexed R., and in the white gills slowly becoming fuscous. Woods etc. C. $4 \times 5\frac{1}{2} \times \frac{3}{4}$. Edible.

**P. villatica** Magn. (792*a*). --P. pale brown. minutely scaly, adpressedly silky, squamose towards the paler margin; S. white. becoming tinged with brown especially at the swollen base; R. white above, yellowish and floccosely scaly below. thick. reflexed; G. pallid, then fuscous cinereous; flesh white. becoming reddish brown when cut; smell unpleasant. Pastures etc. O. $14 \times 7\frac{1}{2} \times 3$. Edible.

This is the "gigantic mushroom" of the *newspapers.*

**P. exserta** Rea. - P. white. becoming yellowish ochraceous and covered with minute. adpressed scales; S. white, bleeding when broken. almost smooth; R. white, covered on the underside with yellowish, fugacious warts. large. thick, double; G. whitish, then pinkish. finally fuscous. flesh white. turning bright red when broken and exuding a bright red juice; spores deep ochre in the mass. Pastures. O. $7 \times 6 \times 2$. *Edible.*

**P. hæmorrhoidaria** Magn. (794). -Differs from *P. exserta* in its rufous or brownish P. covered with broad adpressed darker scales and with margin at first incurved. its silky. fibrillose. white. membranous R. becoming discoloured and its rosy flesh-coloured then purple-umber G. The white S. becomes blood-red when bruised. and the flesh blood-red when broken. Woods, and especially under conifers. C. $5 \times 4\frac{1}{2} \times 1$. Edible.

**P. sylvatica** Quél. (793) also generally has rufescent flesh, often yellowish at the apex. P. subferruginous. with rufescent scales. becoming floccosely squamulose except at the disc. margin often rimosely incised; S. dingy white, fibrillose below the R.; R. white. distant. floccose below, membranous, fugacious; G. white. then reddish. finally cinnamon or umber-fuscous. Woods and under cedars. F. $3 \times 3 \times \frac{3}{4}$. Edible.

**P. peronata** W. G. Sm. (794*a*). -Differs from 787 in its hollow peronate S.; P. pale dull ochraceous. densely covered with small silky scales; S. white, marginately bulbous at the base; R. yellowish. large. spreading; G. pink. then pale purple-brown. very distant from the S.; flesh white, becoming brownish in the S. when cut. Pine woods. R. $3\frac{1}{2} \times 6 \times \frac{1}{2}$. Edible.

**P. comtula** Quél. (795). P. yellowish white, disc often tawny. adpressedly fibrillose silky. convex. then plane, obtuse; S. white or concolorous, satiny, apex striate; R. concolorous. membranous, median. fugacious; G. flesh-colour. then fuscous flesh-colour. free. crowded; smell and taste strong of anise. Woods etc. C. $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{16}$. Edible.

***P. amethystina*** *Quél.- Differs from* 795 in the white P. becoming pink. lilac, or amethyst from the centre outwards. in the glabrous and subbulbose S., the white satiny R., and light grey-tan bay-brown G.; smell pleasant. Woods etc. O. $1\frac{1}{2} \times 1\frac{3}{4} \times \frac{1}{4}$. Edible.

**P. sagata** Hem. (797). Differs from 795 in the yellowish-tawny or reddish-brown. smooth. subpelliculose, shining P.. yellowish smooth S., white distant R.. and pinkish. then umber. G.; smell pleasant. Under beeches. R. $2\frac{1}{2} \times 2\frac{3}{4} \times \frac{1}{4}$. Edible.

**P. rusiophylla** W. G. S. (798). Differs from 795 in its livid white or ochraceous P. with subfuscous or dingy violaceous disc. its concolorous. median. erect, persistent R., and its pallid, greyish. then black G.; smell pleasant. Woods etc. R. $2 \times 2 \times \frac{1}{4}$. Edible.

**P. echinata** Quél. (800) (*Lepiota*). --P. blackish grey, more or less olivaceous, convex. then plane. very thin, finely granular. margin pale and appendiculate with the veil; S. dark brown becoming vinous. base covered with pulverulent, fugacious granules; R. reddish, floccose. granular below, inferior, fugacious; G. blood-red, free. ventricose; flesh brownish or reddish; spores pale ochraceous in the mass. becoming reddish with age; smell strong. Woods etc., greenhouses. O. $2 \times 3 \times \frac{1}{4}$. Edible.

Mycelium and soil are rolled together into a compact ball at the base of the S.. The fungus becomes jet-black when dry.

## XXXIII. PILOSACE Quél.

(Greek *pilos*, felt, *sakos*, a garment—from the pelliculose cap.)

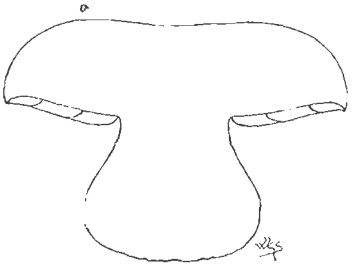

Fig. 35. Section of *Pilosace algeriensis* Quél. (× ½.)

*Pilosace* agrees in structure with *Hiatula*, *Pluteus*, and *Pluteolus*, but has purple-brown spores. Cap fleshy; stem fleshy, stout; gills free or remote. The only British species grows on the ground.

**P. algeriensis** Quél. (801). P. snow-white, then reddish or bistre, fleshy, convex, then plane, smooth, shining; S. white, silky, solid, incrassated at the base; G. salmon to rose, becoming dark purple-madder, free, horizontal, narrow; flesh white; smell and taste pleasant. On the ground. R. $3\frac{3}{4} \times 1\frac{1}{2} \times 1\frac{1}{4}$. Edible.

## XXXIV. STROPHARIA Quél.

(Greek *strophos*, a sword-belt—in reference to the ring.)

Fig. 36.—*Stropharia æruginosa* Quél. (× ½.)

*Stropharia* agrees in structure with *Armillaria* and *Pholiota*, but has purple-brown spores. The cap is sometimes provided with a pellicle, and may be scaly and viscid or innato-fibrillose and dry; the stem is fleshy and annulate, the ring being membranous or fibrillose-floccose; the gills are more or less adnate, at first whitish or pale clay-brownish. Mostly growing on wood, sometimes on the ground. There are about twenty British species. *Hypholoma* differs in that the cortinate veil remains as a fringe on the margin of the cap and does not form a ring on the stem.

59. **S. æruginosa** Quél. (802). (Latin *æruginosus*, full of copper rust.)

Cap bluish-verdigris from the azure-blue viscid pellicle, becoming brownish yellow when the pellicle separates, often flecked with white, fugacious squamules, fleshy, campanulato-convex, then flattened, subumbonate, obtuse when larger; stem concolorous, covered with white, fugacious squamules below the ring, smooth above, equal, viscid; ring whitish above, concolorous below, distant, floccose, fugacious; gills white, then fuscous, finally somewhat purple, adnate, plane, edge often white; flesh bluish; smell strong or none.

Woods, pastures, etc. Common. $3\frac{1}{2} \times 4 \times \frac{1}{2}$. Suspicious.

**S. inuncta** Quél. (804). P. light yellow, becoming livid purple with dense gluten, convexo-plane, pelliculose, smooth, margin substriate; S. shining white, flexuose, dry, silky fibrillose below the white, very thin, fugacious R., pruinose above; G. whitish, then fuscous, adnate with a decurrent tooth. Pastures etc. C. $2 \times 3\frac{1}{2} \times \frac{3}{16}$.

**S. coronilla** Quél. (805).—P. ochraceous tawny, convexo-expanded, obtuse, margin white floccose; S. white, then yellowish, attenuated at the base; R. white, striate above; G. fuscous violaceous, then purplish blackish, with the edge white, sinuato-adnate, crowded. Pastures etc. C. $1\frac{1}{4} \times 1 \times \frac{1}{4}$. Suspicious.

**S. squamosa** Quél. (808).—P. brownish and viscoso-pelliculose when moist, then becoming ochraceous, disc tawny, sprinkled with superficial, fugacious, piloso-fasciculate, concentric scales, expanded, obtuse; S. pallid, ferruginous at the base, pulverulent above the R., squamose or densely strigose below; R. pallid, membranous, distant; G. cinereous, then blackish, edge white, adnate, ventricose. Woods etc. C. $2\frac{1}{4} \times 6 \times \frac{3}{16}$. Suspicious.

60. **S. semiglobata** Quél. (814). (Latin *semiglobatus*, hemispherical.)

Cap light yellow, fleshy, hemispherical, very obtuse, smooth, viscid, shining when dry; stem yellow, apex paler, equal, hollow, tense, and straight, smooth, smeared with the glutinous veil; ring viscid, thin, incomplete, distant; gills pale purplish, clouded with black, adnate, very broad, plane; flesh pallid.

On horse-dung. Common. $1\frac{1}{4} \times 5\frac{1}{2} \times \frac{1}{8}$. Suspicious.

**S. stercoraria** Quél. (813) is scarcely distinguishable macroscopically from 814; P. hemispherical, then expanded, margin sometimes striate; S. stuffed with a separable fibrous pith, flocculose below the ring; G. at first white, then umber or olivaceous-fuscous, very broad behind; said to arise often from a sclerotium. On dry dung. C. $1\frac{1}{2} \times 3\frac{1}{4} \times \frac{1}{8}$. Poisonous.

## XXXV. HYPHOLOMA Quél.

(Greek *hyphe*, a web, *loma*, a fringe—from the web-like veil.)

Fig. 37. *Hypholoma fasciculare* Quél. (× ¼.)

*Hypholoma* agrees in structure with *Tricholoma*, *Entoloma*, and *Hebeloma*, but the spores are purple-brown. The cap with the margin incurved at first is fleshy; the stem is fibrous or fleshy; the ring is represented by a circle of fine dark-coloured hairs or fibrils on the stem, and similar fibrils belonging to the veil adhere to the margin of the cap; the gills are sinuate or adnate.

Growing on wood, often densely cæspitose. There are about twenty-five British species.

61. **H. sublateritium** Quél. (822). (Latin *sub*, somewhat, *lateritium*, brick-colour.)

Cap tawny brick-red, paler round the margin, covered with a superficial, somewhat silky, whitish cloudiness (from the veil), fleshy, convexo-plane, obtuse, discoid, dry, even, becoming smooth; stem

yellow, ferruginous downwards, stuffed, firm, stout, attenuated downwards, scaly-fibrillose, fibrils pallid; cortina at first white, finally black, superior; gills dingy yellowish, darker at the base, then fuliginous, and at length inclining to olivaceous, sinuate, arcuate, or decurrent, narrow, somewhat crowded; flesh yellowish, ferruginous at the base of the stem; taste bitter.

Subcæspitose in woods etc. Common. Jan. to Dec. $3\frac{1}{2} \times 5 \times \frac{1}{2}$.

**H. capnoides** Quel. (823).—Differs from 822 in its ochraceous-yellowish, smooth, often wrinkled P. with appendiculate margin, in its pallid S. with whitish apex, in its whitish or bluish-grey, then fuscous-purple, adnate G., and whitish flesh. On coniferous stumps. C. $3 \times 5 \times \frac{3}{4}$.

62. **H. fasciculare** Quél. (826). (Latin *fascicularis*, tufted.)

Cap light yellow, disc often darker, fleshy, thin, convex, then flattened, subumbonate or obtuse, even, smooth, dry; stem concolorous, hollow, thin, incurved or flexuose, fibrillose; cortina yellowish white, fibrillose, torn; gills sulphur-yellow, becoming green, adnate, very crowded, linear; flesh light yellow; smell and taste very bitter.

On stumps and on the ground. Common. Jan. to Dec. $2\frac{3}{4} \times 4\frac{3}{4} \times \frac{1}{4}$.

**H. epixanthum** Quél. (824) can be distinguished from 826 by the absence of bitter taste and by the G. being first yellowish white or citron-yellow, then cinereous. Cæspitose on stumps. C. $3\frac{1}{4} \times 6 \times \frac{3}{4}$.

63. **H. lachrymabundum** Quél. (832) (*H. pseudostorea* W. G. Sm., 831). (Latin *lachrymabundus*, weeping—from the tear-like drops on the gills.)

Cap whitish, becoming fuscous and pale round the margin, fleshy convex, obtuse, piloso-scaly, the minute scales darker, margin appendiculate with the veil; stem whitish, then somewhat fuscous, hollow, slightly attenuated upwards from the somewhat thickened, often yellowish base, curved, fibrillosely scaly; cortina white, separate, fibrillose; gills whitish, then fuscous purple, edge whitish, often exuding drops in wet weather, adnate, crowded; flesh white.

Cæspitose on stumps or on the ground. Frequent. Sept. to Dec. $3 \times 3\frac{1}{2} \times \frac{1}{4}$.

**H. pyrotrichum** Quél. (833) is distinguished from 832 by its tawny-red, densely fibrillose P., its tawny S., which is usually squamose with small tawny-red scales, the tawny C., and the pallid then tawny G. with flocculose white edge; flesh tawny. Cæspitose about roots. F. $3 \times 3 \times \frac{1}{4}$.

**H. velutinum** Quél. (834).—Differs from 832 in its lurid to tawny, then yellowish, hygrophanous, expanded, obtusely umbonate, tomentosely fibrillose P., and in its G. being pale yellowish at first, then umber, dotted by spore-masses (beaded with drops); flesh pallid. Woods etc., rarely on stumps. C. $4 \times 5 \times \frac{1}{2}$.

**H. Candolleanum** Quél. (838).—P. date-brown, then white, disc ochraceous, campanulate, then flattened, smooth, margin appendiculate with the white then fuscous veil; S. white, fibrillose, apex striate; G. violaceous, then fuscous cinnamon, edge whitish at first, crowded. Woods and stumps. C. $3 \times 3\frac{1}{2} \times \frac{1}{4}$. Edible.

**H. appendiculatum** Quél. (839).—Differs from 838 in the date-brown P. becoming tawny, at first pruinose, sprinkled with a few fugacious specks, then smooth, ochrey pale and slightly wrinkled when dry, in the pruinose S. apex, and in the G. being at first white, then flesh-colour, and finally fuscous. Woods, etc. $3 \times 4 \times \frac{1}{2}$. Edible.

**H. hydrophilum** Quél. (843).—P. date-brown when moist, tawny or tan-colour when dry, globose, then expanded, pruinose, striate near the margin when moist, wrinkled when dry, margin often undulate, appendiculate with the white fugacious veil; S. white, becoming somewhat ferruginous below, curved, base fibrillose; G. whitish, then date-brown fuscous, adnate, ventricose, crowded, often exuding hyaline drops. Cæspitose on stumps etc. C. $2\frac{3}{4}\times4\times\frac{1}{4}$. Edible.

## XXXVI. PSILOCYBE Quél.

(Greek *psilos*, naked, *kube*, a head.)

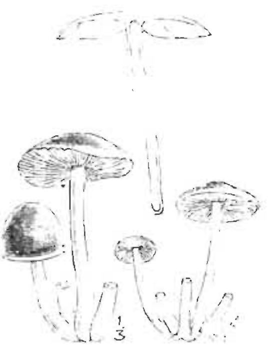

Fig. 38. *Psilocybe spadicea* Quél. (× ½.)

*Psilocybe* agrees in structure with *Collybia*, *Leptonia*, *Naucoria*, and *Panæolus*, but the spores are purple-brown. The somewhat fleshy cap is smooth, with the margin at first incurved; the stem is subcartilaginous, rigid, or tough, and often rooting; the gills are fuscous, brownish, or purplish, and adnate, sinuato-adnate, or adnexed. The species are generally somewhat small, and grow usually on the ground, sometimes in clusters. There are about thirty British species.

64. **P. semilanceata** Quél. (862). (Latin *semi*, half, *lanceolatus*, spear-shaped.)

Cap yellow, green, or fuscous, submembranous, acutely conical, almost cuspidate, never expanded, pellicle viscid, separable in wet weather, margin incurved when young, substriate; stem pallid, equal, often flexuose, with an internal pith, smooth, cortinate when young; gills cream-colour, then purple-black, ascending within the apex of the cone, adnexed, almost linear, crowded; flesh white.

Pastures, roadsides, etc. Common. Aug. to Dec. $\frac{1}{2}\times\frac{3}{8}\times\frac{1}{16}$. Suspicious.

**P. ericæa** Quél. (846).—P. tawny ferruginous, tawny yellow, or date-brown, convex, then expanded, obtuse, subviscid when wet, shining when dry; S. paler than the P., becoming yellowish, somewhat smooth or silky; G. pallid, becoming blackish, adnate, edge whitish; flesh yellow. Heaths etc. C. $1\frac{1}{4}\times4\times\frac{1}{8}$.

**P. subericæa** Sacc. (847).—Differs from 846 in its more tawny, smooth P., in its pallid to yellow S., and its pallid then fuscous-purple, sinuato adnate G. Heaths etc. C. $2\times2\frac{1}{2}\times\frac{3}{16}$.

**P. bullacea** Quél. (857).—P. dark tawny, tan when dry, hemispherical, obtuse, then expanded, separable pellicle viscid, margin at first appendiculate with the white, floccose, fugacious veil; S. slightly tawny, then yellow, fuscous ferruginous at the base, subfibrillose, apex pruinose; G. livid white, then fuscous purple, somewhat triangular, crowded. Horse-dung etc. C. $1\times1\times\frac{1}{8}$.

**P. spadicea** Quél. (864). P. date-brown umber, becoming pale and often cracked when dry, hygrophanous, margin inflexed when young; S. white, often curved, smooth, silky; G. whitish, then flesh-colour, at length umber, rounded adnexed, crowded. On stumps or on the ground. O. $2\frac{1}{2}\times4\times\frac{1}{4}$. Edible.

**P. fœnisecii** Quél. (868).—P. pale fuliginous fuscous or brown, becoming pale from the disc outwards on drying, campanulato-convex; S. pallid and pulverulent, then rufescent and naked; G. purplish fuscous or fuscous brown, variegated, adnate, subdistant, edge white fimbriate. Pastures etc. C. $\frac{3}{4}\times3\times\frac{1}{16}$. Edible.

## XXXVII. PSATHYRA Quél.

(Greek *psathuros*, friable.)

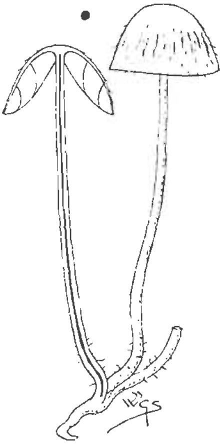

Fig. 39.—*Psathyra bifrons* Sacc. (× ½.)

*Psathyra* agrees in structure with *Mycena*, *Nolanea*, *Galera*, and *Psathyrella*, but has purple or purplish-brown spores. The cap is fleshy or submembranous, hygrophanous, conical or campanulate, then expanded, with the margin at first straight and adpressed to the subcartilaginous, fistulose, fragile stem; the gills are pale at first, becoming purple or fuscous, adnate, adnexed, or free. The species are small, and grow on the ground or on rotten wood. There are about twenty British species.

**P. corrugis** Quél. (876). P. rose or pale flesh-colour, becoming paler when dry, submembranous, substriate when moist, wrinkled when dry, atomate; S. whitish or rufescent; G. white, then violaceous, and finally blackish, edge white, adnate, or sinuato-adnate, ventricose. Woods etc. C. 2×3×$\frac{3}{16}$.

**P. fatua** Quél. (885). P. tan-fuscous, ochraceous clay when dry, oval, then campanulate, and finally expanded, adpressedly fibrillose when young, then smooth, rugulose and whitish clay-colour when full grown, margin subundulate, sometimes appendiculate; S. shining white, fibrillose, then smooth, apex striate and pruinose, base white, villose; G. white, then fuscous, adnate, crowded, edge often white; caespitose. Gardens etc. R. 1×3½×$\frac{3}{16}$. Edible.

### SPORES BLACK.

## XXXVIII. ANELLARIA Karst.

(Latin *anellus*, a small ring).

Fig. 40.—*Anellaria separata* Karst. (× ¼.)

*Anellaria* agrees most closely structurally with *Amanita*, but has black spores. The cap is fleshy, persistently conico-campanulate, shining when dry, with the margin exceeding the gills; the stem is lustrous, somewhat firm, and fistulose; the ring is membranous, persistent, or fugacious; the gills are adnate or often almost free. The three British species grow in rich grassy places or on dung.

**A. separata** Karst. (894). P. clay whitish or yellowish, viscid, smooth, often wrinkled or cracked when old, margin often appendiculate with the veil; S. whitish, gradually attenuated upwards from the thickened base; R. white, distant, entire, often striate; G. whitish, then cinereous black, often with whitish edge. Horse-dung. C. 2½×7×¼.

**A. fimiputris** Karst. (896).—Differs from 894 in the imperfect, zone-like, superior R; P. fuliginous cinereous; S. pallid, equal; G. livid blackish, adfixed. Horse-dung. C. 1½×5½×¼.

## XXXIX. PANÆOLUS Quél.

(Greek *panaiolos*, all variegated—from the variegated gills.)

*Panæolus* agrees most closely in structure with *Collybia*, *Leptonia*, *Naucoria*, and *Psilocybe*, but has black or fuscous-black spores.

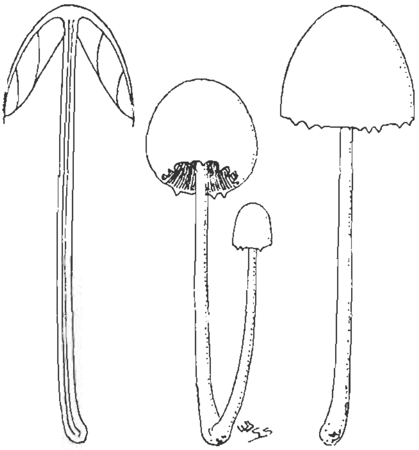

Fig. 41.—*Panæolus campanulatus* Quél. (× $\frac{1}{2}$.)

The cap is slightly fleshy, conical, not expanding, with the margin exceeding the gills, viscid when moist, shining when dry; the gills are adnate or adnexed, and variegated with the dark spores. The species grow in rich grassy places or on dung. There are about eleven British species.

**P. sphinctrinus** Quél. (901).—P. fuliginous or fuliginous grey, livid or somewhat silky when dry, hygrophanous, opaque, margin crenate with the appendiculate, fugacious, white veil; S. fuliginous grey, fragile, pruinose, apex smooth; G. cinereous blackish, edge often white, adnato-ascending, crowded; flesh reddish. Rich pastures etc. C. $1 \times 3 \times \frac{1}{16}$.

**P. campanulatus** Quél. (903).—P. fuscous fuliginous, rufescent when dry, slightly viscid when moist, then somewhat shining; S. white pruinose, then rufescent, tense and straight, apex striate; G. varying grey to black, adnato-ascending, crowded, edge often white and exuding watery drops; flesh reddish. Horse-dung etc. C. $1\frac{1}{2} \times 4 \times \frac{1}{8}$.

**P. papilionaceus** Quél. (902). Differs from 903 in the pallid or pale grey, hemispherical, pruinose P. with reddish disc, rimosely cracked when dry, the white pulverulent S. apex, the blackish, broadly adnate G. without exudate, and the pallid then whitish flesh. Dung etc. C. $1\frac{3}{4} \times 4 \times \frac{1}{8}$.

## XL. PSATHYRELLA Quél.

(Diminutive of *Psathyra*.)

*Psathyrella* agrees in structure with *Mycena*, *Nolanea*, *Galera*, and *Psathyra*. The cap is membranous, striate, with margin straight, adpressed to the stem, and not exceeding the gills; the gills are adnate or free. The species grow on rich ground, sometimes on wood. There are about twelve British species.

**P. gracilis** Quél. (910).—P. fuliginous, livid or pale grey, tan, rosy, or whitish when dry, hygrophanous, campanulate, pellucidly substriate round the margin; S. whitish, tense and straight, fragile, naked, base villose; G. whitish, then cinereous blackish, edge rose-colour, adnate, subdistant. Woods etc. C. 2×4×1.

**P. atomata** Quél. (918).—Differs from 910 in the usually more reddish, shining, atomate P., in the lax, slightly bent S., with white pulverulent apex, and in the G. edge not being rose-coloured. Woods etc. C. $1\times3\times\frac{1}{16}$.

**P. disseminata** Quél. (920).—P. whitish or yellowish, becoming cinereous, scurfy, then smooth, deeply striate, sulcate; S. fragile, often curved, slightly scurfy, then smooth, arising from a byssoid white mycelium; G. whitish, then blackish, adnate. Densely crowded or cæspitose on old stumps etc. C. $\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{16}$.

The genera described in the previous pages were treated by Fries as subgenera of the genus *Agaricus*, and this arrangement is followed in the drawings in the Public Gallery.

## XLI. COPRINUS Fr.

(Greek, *kopros*, dung—from the frequent habitat.)

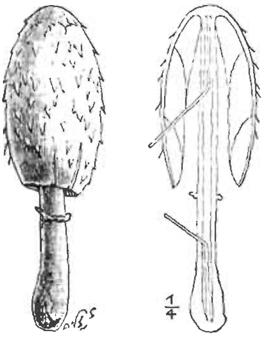

Fig. 42.—*Coprinus comatus* Fr. (×¼.)

In *Coprinus* the cap is fleshy or membranous, at first cylindrical or ovate, and usually floccose or scurfy with the margin originally straight and adpressed to the stem; the stem sometimes has a ring or a volva; the gills are free, adnate, or attached to a collar, very thin and parallel-sided, at first white and closely pressed together; the spores are black, violet-black, chocolate, or fuscous; the species are cæspitose or solitary and grow on the ground, on dung, or on wood. There are about fifty British species.

One of the chief characteristics of *Coprinus* is the so-called "deliquescence," which gives the popular name "inky cap" to these fungi. This process of autodigestion is correlated with certain structural points; the gills are more or less parallel-sided and not slightly wedge-shaped as in other genera, and the spores ripen (and are discharged) from below upwards on each gill. Autodigestion renders important mechanical assistance in the process of spore-discharge, in that it leads to the removal of those parts of the gill which have already shed their spores, and thus permits of the continued opening of the cap and provides the necessary spaces for the violent discharge of the spores from the basidium. The inky drops produced by autodigestion consist of a brown fluid containing granules, but not spores, the dark colour being produced owing to the presence of an oxydising enzyme. Cystidia are exceptionally well developed in the genus, and probably always have a mechanical function in serving to prevent opposing hymenial surfaces from touching during the development of the basidium and spores. The paraphyses are large, and appear to act as spacing agents in keeping basidia apart, so that their spores can develop freely; they also help in bringing about the expansion of the cap by their gradual increase in size. The basidia are usually of two different lengths, one set being considerably longer than the other; this permits of the development of a greater number of basidia in a given area. The basidia may even be of four different lengths, as in *C. micaceus*.

The recent study of the genus has shown that two different strains exist in certain species (*cf.* p. 15).

65. **C. comatus** Fr. (921). (Latin *comatus*, hairy.)

Cap white, becoming pinkish at the margin, and finally black, fleshy, cylindrical, then campanulate, the continuous cuticle soon separating into adpressed shaggy scales, which become ochraceous at the apices, disc deep ochraceous, remaining entire, at length striate, margin often torn and unequal; stem white, then dingy or lilac-white, hollow, attenuated upwards from the bulbous rooting base, fibrillose, silky, shining; ring white, membranous, thin, torn, movable, fugacious; gills white, then pink, finally black and deliquescent, free, separate from the stem, linear; flesh white; taste mild.

Woods, pastures, roadsides, generally near human habitations. April to December. Common. $4\frac{1}{2} \times 9 \times \frac{3}{4}$. Edible.

This well-known esculent is best for the table when young and the gills are pink. The cap should be peeled downwards and the stem rejected.

In this species the gills are kept apart during development by a thickening of the gill-margin.

C. ovatus Fr. (922).—Differs from 921 only in its smaller size and ovate P. Rich ground, pastures. O. $3 \times 5 \times \frac{3}{8}$. Edible.

66. **C. atramentarius** Fr. (926). (Latin *atramentarius*, inky.)

Cap livid fuliginous, becoming hoary with adpressed silky lustre, fleshy, ovate, obtuse, longitudinally and deeply sulcate and ribbed, minutely mealy, repand-unequal at the margin, disc often squamulose, slightly adpressedly silky at the sides; stem white, at first short and ventricose, fusiform, then elongato-attenuated upwards, firm, longitudinally fibrillose, apex smooth, base often with a few tawny squamules; ring white, basal, very fugacious; gills whitish, then brown-black, free, ventricose, edge flocculose; flesh fuliginous, scissile; taste mild; cæspitose or solitary.

Woods, pastures, gardens, usually connected with buried wood. Common. May to Dec. $3\frac{1}{2} \times 7 \times \frac{3}{4}$. Edible.

*Growths of this fungus sometimes dislodge the pavement in towns.*

In this species very large cystidia extend across the lamellar spaces, and by their number and uniform distribution make it impossible for the gills to sag laterally during development. They do not, however, act as a hindrance to the escape of the spores from between the gills, owing to the fact that they undergo auto-digestion a short time previous to the basidia and paraphyses in their immediate neighbourhood.

Bulliard speaks of the "ink" of this species as being excellent for wash-drawings or pen-work, when boiled with a little water and cloves to prevent mouldiness. Boudier eighty years later experimented with the fluid. His method of preparing it is to gather the fungus at maturity and place it in a vessel. After being allowed to stand for some days, about three-quarters of the supernatant fluid is decanted off; a little gum arabic is then added. The ink is an intense black or a little brownish and much like Chinese ink. It has the disadvantage like the latter of being easily washed off, but is unaffected by the usual bleaching-agents, such as oxalic acid; only chlorine and hypochlorites decolour it somewhat.

*Coprinus comatus* can also be used for making ink, but does not give so black a colour. Ink prepared in this way contains the spores of the fungus. Boudier suggested that, as it cannot therefore be counterfeited without the fraud being immediately discoverable on examination with the microscope, it might be used for certain important documents and signatures. The spores offer great resistance to decomposition and loss of colour. It has been proposed that other spores with well-marked characteristics might be added to the ink to prevent fraud.

67. **C. picaceps** Fr. (929). (Latin *picaceus*, pertaining to a magpie—from the appearance of the cap.)

Cap fuliginous black, variegated with broad, unequal, superficially separating, white scales from the breaking up of the universal woven veil, striate; stem white, attenuated upwards from the bulbous base, fragile, smooth; gills white, then pinkish, at length black, free, ventricose; flesh pallid, brownish under the cuticle of the cap; smell none or fœtid.

Frondose woods, especially beech and on grassy broadsides. Uncommon. Sept. to Dec. $4 \times 11 \times \frac{1}{4}$. Suspicious.

Stated sometimes to be sterile and white, the gills deliquescing into a milk-white fluid. The structure is similar to that of *C. atramentarius*.

68. **C. niveus** Fr. (936). (Latin *niveus*, snow-white.)

Wholly snow-white. Cap submembranous, ovate, soon campanulato-expanded, at length revolute, split and torn, mealy, floccose, often squamulose; stem attenuated upwards, very fragile, densely covered with fugacious, upward pointing flocci, becoming smooth; gills white, then flesh-colour and finally blackish, adnexed, narrow; flesh white.

On horse-dung. Common. May to Dec. $2\frac{1}{4} \times 4\frac{1}{2} \times \frac{3}{16}$.

Frequent on mushroom-beds, sometimes so abundant as to prevent the growth of the mushroom.

The cystidia on the face of the gills are even larger than those of *C. atramentarius*, and are amongst the largest fungal cells known. They stretch across the interlamellar spaces during the early stages of the development of the cap, and serve to keep the gills apart. However, just before spore-discharge begins, the cap expands and the gills become widely separable, and as a result the cystidia no longer bridge the space.

**C. fimetarius** Fr. (934).—Differs from 936 in the ashy-grey P., densely covered with white fugacious flocci, then striate, in the S. with thickened base and downward pointing flocci, and the white, then black, free, lanceolate G.; flesh of P. fuscous. Manure-beds etc. F. $2\frac{3}{4} \times 8 \times \frac{3}{16}$.

69. **C. micaceus** Fr. (938). (Latin *micaceus*, glittering.)

Cap yellow-ferruginous or yellowish livid, disc darker, at length date-brown fuscous, ferruginous ochraceous when dry, submembranous, oval, then campanulate, undulato-lobed, rimosely split, striate, at first covered with glistening micaceous particles, soon naked and becoming sulcate, disc even, margin plicate and irregular; stem white or whitish, hollow and soft, often curved, equal, silky, fibrillose, becoming smooth; gills white or isabelline, then brown or livid at the edge, finally fuscous blackish, adnexed, lanceolate; flesh pallid.

Densely cæspitose on stumps, old posts, and buried wood. Common. Jan. to Dec. $3 \times 7 \times \frac{3}{16}$. Edible.

**C. radiatus** Fr. (954).—P. dingy yellowish or greyish with darker disc, at first covered with cinereous down, membranous, clavate, then flattened, radiato-plicate, pellucid; S. hyaline, often pruinose when young, base silky and villose; G. whitish, then pallid, blackish, free, few, distant. Cow and horse dung. C. $1\frac{1}{4} \times 3 \times \frac{1}{16}$.

**C. domesticus** Fr. (956).—P. fuliginous, disc date-brown, ovate, then campanulate, furfuraceo-squamulose, then opening into furrows and flattened, undulato-sulcate; S. white, attenuated upwards, adpressedly silky, then polished; G. white then flesh-colour, finally fuscous blackish, adnexed, linear. Damp carpets, cellars, gardens, etc. C. $3 \times 3\frac{1}{2} \times \frac{1}{4}$.

**C. stercorarius** Fr. (957).—P. whitish, ovate, then campanulato-expanded, pellucid, covered with dense, somewhat persistent, shining white meal, margin striate; S. *shining white, attenuated upwards from the thickened base*, pruinose, then smooth; G. white, soon black, adnexed, ventricose. Dung, rich soil, etc. C. $1\frac{1}{2} \times 4 \times \frac{1}{8}$.

*The structure is similar to that of C. atramentarius.*

**C. ephemerus** Fr. (958).—P. greyish, disc rufescent, ovato-clavate, then campanulato-expanded, radiato-sulcate, disc elevated, slightly scurfy, then naked; S. whitish, pellucid; G. whitish, then fuscous, at length black, reaching the S., linear. Horse and rabbit dung. C. $1 \times 3 \times \frac{1}{16}$.

70. **C. plicatilis** Fr. (960). (Latin *plicatilis*, folded.)

Cap fuscous, then bluish-grey cinereous, disc fuscous or rufescent, ovato-cylindrical, then campanulate, soon expanded, opening into furrows, sulcato-plicate, for the most part smooth, disc broad, even, at length depressed; stem pallid, somewhat pellucid, equal, smooth; gills cream-colour, then grey, at length greyish black, remote from the stem, and adnate to a collar formed by the dilated apex of the stem, distant; flesh whitish.

Woods, pastures, roadsides, and gardens. Common. April to Dec. $1\frac{1}{2} \times 4 \times \frac{1}{16}$.

## XLIII. BOLBITIUS Fr.

(Greek *bolbiton*, cow-dung—from the frequent habitat of the species.)

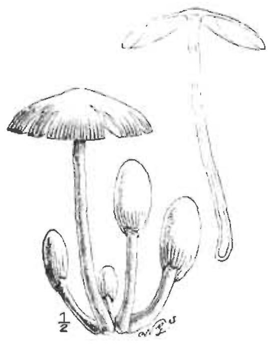

Fig. 43.—*Bolbitius fragilis* Fr. ($\times \frac{1}{2}$.)

*Bolbitius* has a *fleshy-membranous* to membranous, moist, mucid or viscid cap, at first conical or ovate with the striate or sulcate margin adpressed to the stem; the gills are free or adnexed; the spores are ochraceous, ferruginous, fuscous, or salmon. The species grow on dung or on rich soil. There are about eleven British species.

*Bolbitius* is usually classed with *Coprinus*, but, although there are many similarities in habit and habitat, there are important structural differences. As Buller has shown, the gills are wedge-shaped, the spores do not ripen from below upwards on each gill, and autodigestion has no relation to spore-discharge, but is a *post-mortem* change; the turning of the cap into a brown mucous mass takes place when spore-discharge has ceased and the whole cap is exhausted and dead.

71. **B. fragilis** Fr. (968). (Latin *fragilis*, fragile.)

Cap light yellow, then becoming pale, submembranous, pellucid, conical, then expanded, subumbonate, smooth, viscid, margin striate and *often crenulate*; stem yellow, *hollow*, very fragile, attenuated upwards, naked, smooth; gills yellow, then pale cinnamon, attenuato-adnexed, almost free, ventricose; flesh yellowish.

Horse-dung, road-scrapings, etc. Common. April to Nov. $2\frac{1}{4} \times 4 \times \frac{1}{8}$.

**B. titubans** Fr. (969).—P. light yellow at the disc, paler and becoming greyish at the margin, ovato-campanulate, then flattened and split, margin plicate; S. white, shining, sometimes mealy; G. ochraceous or *purplish, then fuscous, flesh-colour*, or ferruginous, adnexed or free. Rich pastures, gardens, etc. C. $2 \times 4 \times \frac{1}{16}$.

## XLIII. CORTINARIUS Fr.

(Latin *cortina*, a veil.)

*Cortinarius* is distinguished by the presence in the younger stages of an arachnoid cortina which connects the edge of the cap with the stem; there is also frequently a universal veil, which, on collapsing, leaves a ring, a sheath, or shreds on the stem; the cap is fleshy; the stem is spongy-fleshy in the larger forms, rigid and subcartilaginous in the smaller ones; the gills are dry and persistent, and, when young, may be white, yellow, grey or olive, blue, violet, purple, red, or brown, but as they mature become discoloured by the cinnamon or rusty-brown spores with which they are pulverulent; they are adnate, sinuate, sinuato-adnate, or decurrent. The species are variable in size and changeable in colour. All are terrestial, and certain forms are known to form mycorrhiza with tree roots (*cf.* p. 9). There are over two hundred British species.

The genus is divided into subgenera.

Subgenus 1. PHLEGMACIUM Fr.

Cap fleshy, viscid; stem firm, dry; veil partial.

i. Partial veil depending in the form of a ring from the apex of the nearly equal or clavate stem.

*a*. Gills violaceous or *purplish, then cinnamon*.

Fig. 44.—*Cortinarius (Phlegmacium) fulgens* Fr. ($\times \frac{1}{3}$.)

**72. C. varius** Fr. (981). (Latin *varius*, changeable.)

Cap bright ferruginous tawny or yellow tawny, compact, hemispherico-flattened, very obtuse, margin incurved at first, thin, and fringed with the cortina; stem shining white, compact, adpressedly flocculose, the superior veil pendulous, base bulbous; cortina white, silky; gills violaceous-purplish, then ochraceous-cinnamon with a violaceous edge, emarginate, thin, somewhat crowded; flesh white, firm.

Woods. Frequent. Sept. to Nov. $4 \times 4 \times \frac{3}{4}$. Edible.

**C. cyanopus** Fr. (982).—Differs from 981 in its date-brown livid, then tan and opaque P. and in its violaceous S. becoming whitish. Oak woods etc. F. $4 \times 4 \times \frac{1}{2}$. Edible.

**C. variicolor** Fr. (983).—Differs from 981 in its date-brown, then fulvous reddish P., with darker disc and violet tomentose margin, in its villose then flocculose S., often with two to four zones formed by the violet Co., in its blue denticulate G.,

**C. largus** Fr. (984).—Differs from 981 in its date-brown tawny P., sometimes violet when young, adpressedly silky fibrillose when dry, usually rivuloso-squamulose, its white S., tinted violaceous, its thick Co., and crowded, minutely denticulate G.; subcæspitose. Pine woods. $2\frac{3}{4} \times 4\frac{1}{4} \times \frac{3}{4}$. Edible.

*b.* Gills pallid, then clay-colour.

**C. triumphans** Fr. (974).—P. yellow, margin lighter, disc sometimes variegated with minute, adpressed, darker scales, convexo-plane, obtuse; S. yellowish white, with several concentric, squamulose, tawny rings, striate. base ovato-bulbous; G. emarginate, crowded. Woods etc. F. $5 \times 5 \times 1$. Edible.

**C. turmalis** Fr. (976).—Differs from 974 in its yellow-tan P., covered with pruinose, villose down when young, its shining white rigid S. with attenuated base, sheathed when young with a white woolly veil, and with a persistent R., formed from the fibrillose Co., and in the serrulated G.; densely cæspitose. Mixed woods. O. $3\frac{1}{4} \times 4\frac{1}{2} \times \frac{3}{4}$. Edible.

*c.* Gills olivaceous.

**C. infractus** Fr. (988).—P. olivaceous-fuliginous, becoming fulvous, convexo-expanded, virgate, often fuscous-zoned near the undulate broken margin; S. concolorous, often with violaceous apex, ovato-clavate, adpressedly fibrillose; G. broad, undulate, crisped; taste bitter; smell nauseous. Woods. O. $3 \times 1\frac{1}{4} \times 1$. Edible.

**C. Berkleyi** Cooke (990).—P. fuliginous or brown, disc darker, often violet-tinged at the plicato-sulcate margin, at first covered with a whitish veil which leaves white patches on the disc, convexo-expanded, silky, becoming paler and rivulose with age; S. white, base bulbous. Woods. O. $7 \times 5 \times 1\frac{1}{2}$. Edible.

ii. Cortina usually inferior, arising from the depressed, or turbinate, marginate bulb; gills more or less sinuate.

*a.* Gills violaceous, blue, or purplish, then cinnamon.

73. **C. glaucopus** Fr. (995). (Greek *glaukos*, pale blue, *pous*, a foot.)

Cap dingy yellow, tan-tawny or clay-colour, very fleshy, compact, convex, then flattened, somewhat repand, often floccoso-scaly, and marked with a raised fuscous zone round the split margin; stem pale azure-blue, becoming yellowish, firm, fibrillose, striate, base marginately bulbous; gills azure-blue, then cinnamon, rounded behind, emarginate, crowded, sometimes crisped; flesh white or bluish, becoming yellowish.

Woods and pastures. Frequent. Aug. to Oct. $3 \times 2\frac{1}{2} \times \frac{3}{4}$.

74. **C. purpurascens** Fr. (998). (Latin *purpurascens*, becoming purple—from the gills becoming purple when bruised.)

Cap bay-brown or date-brown olivaceous, then tawny olivaceous, fleshy, convex, obtuse, glutinous, opaque when dry, spotted, often depressed round the margin, which is at first inflexed, then repand, and marked with a violet-fuscous raised zone; stem intensely pallid azure-blue, darker when touched, fibrillose, base bulbous and somewhat marginate; gills azure-blue, then cinnamon, violaceous purple when bruised, broadly emarginate, crowded; flesh azure-blue.

Woods. Common. Sept. to Nov. $4 \times 3 \times 1$. Edible.

**C. calochrous** Fr. (996).—Differs from 998 in its tawny P., yellow round the margin and guttate, in its yellowish S. with a marginate depressed bulb, in its serrulated G., and white flesh; smell fœtid. Woods etc. F. $3 \times 2\frac{1}{4} \times \frac{3}{4}$. Edible

**C. cærulescens** Fr. (997).—Differs from 998 in its blue-violaceous tinged ochre, sometimes entirely yellow-ochraceous P., with the margin white, pubescent, incurved, then expanded and violaceous, in the blue, violaceous, fibrillosely silky S. with white bulb, the violaceous Co., and pale violaceous flesh. Woods. F. $3 \times 2\frac{1}{2} \times \frac{3}{4}$. Edible.

*b.* Gills white, then clay-colour.

**C. multiformis** Fr. (991).—P. light yellow, clay, or tawny, convexo-plane, sprinkled with the universal white veil; S. white, then yellowish, bulb somewhat marginate; Co. white, fibrillose, fugacious; G. very thin, crowded, edge serrulate. Beech woods. F. $3 \times 2\frac{1}{2} \times \frac{1}{2}$. Edible.

*c.* Gills ferruginous, tawny, or yellow.

**C. turbinatus** Fr. (1000).—P. dingy yellow or green, becoming pale, convexo-depressed, hygrophanous, covered with adpressed fibrils, which are deeper coloured and somewhat squamulose at the disc; S. concolorous, with a globoso-depressed, marginate, turbinate bulb. Beech woods. $6 \times 3 \times \frac{3}{4}$. Edible.

**C. fulgens** Fr. (1002).—P. orange-tawny, convexo-plane, silky-fibrillose or squamulose; S. yellow, densely fibrillose with the yellow Co., which is viscid in wet weather, base acutely bulbous, *then depressed and oblique*; *flesh becoming spongy and tan-colour*. Woods. F. $3\frac{1}{2} \times 2 \times 1$. Edible.

iii. Cortina median or inferior, fugacious; stem at first exserted, somewhat thin, rigid-elastic, externally subcartilaginous, lustrous; cap thin, often hygrophanous.

**C. decolorans** Fr. (1015).—P. persistently yellow, convexo-flat; S. shining white; Co. white, persistent, median; G. purplish, soon cinnamon, thin, crowded; flesh white. Coniferous woods. F. $2\frac{1}{2} \times 3 \times \frac{1}{2}$. Edible.

**C. vespertinus** Fr. (1020).—P. yellowish ochraceous with egg-yellow disc, convexo-plane, glutinous, margin wrinkled; S. shining white, firm, elastic, fibrillose, base swollen; *Co. pallid, inferior, fugacious*; G. bright fulvous-cinnamon, very broad, firm, shining; flesh white. Woods. R. $2\frac{3}{4} \times 4 \times \frac{1}{4}$. Edible.

## Subgenus 2. Myxacium Fr.

Cap slightly fleshy, glutinous, stem viscid; veil universal, glutinous.

i. Stem floccose, peronate, the flocci at first covered with gluten.

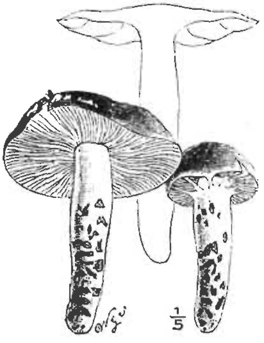

Fig. 45.—*Cortinarius* (*Myxacium*) *collinitus* Fr. ($\times \frac{1}{5}$.)

75. **C. collinitus** Fr. (1023) (Latin *collinitus*, besmeared.)

Cap orange-tawny, fleshy, convex, with the margin bent inwards, then expanded, obtuse, covered with persistent orange-tawny gluten, shining when dry; stem violaceous, white, or yellowish, firm, cylindrical, at length soft, covered with a floccose glutinous veil, which is commonly broken up into concentric scales, and with a viscous fugacious ring near the apex formed from the gluten, which is at first continuous with that of the cap; gills whitish, bluish-grey, or clay-colour, then cinnamon, adnate, somewhat crowded; flesh whitish, brownish under the cuticle of the cap and at the base of the stem.

Woods. Common. July to November. $4\frac{3}{4} \times 5\frac{1}{2} \times 1$. Edible.

**C. arvinaceus** Fr. (1022).—Differs from 1023 in the orange-tawny or reddish tan, undulato-reflexed P., *with substriate margin*, the white, silky, viscous S., and the straw-coloured, then ochraceous, very broad, subdistant G. with crenulate edge. *Beech woods*. R. $3 \times 5\frac{1}{2} \times \frac{1}{2}$. Edible.

**C. elatior** Fr. (1025).—P. livid, light yellow when moist, dingy ochraceous when *dry, or of various colours*, and either whitish or violaceous round the margin, convexo-flat, membranaceous, and longitudinally plicato-wrinkled to the disc: S. violaceous or lilac, becoming white, attenuated at both ends, fibrillosely floccose; Co. concolorous, viscid, fugacious; G. ochraceous or lilac, then dark brown cinnamon, connected by veins or wrinkled at the sides. Woods. C. $4 \times 6\frac{1}{2} \times 1$. Edible.

**C. mucifluus** Fr. (1024).—Differs from 1025 in its livid-clay, campanulato-expanded, then reflexed and repand P., smeared with hyaline gluten, and with striate margin, in the white or tinged blue S., and the clay to watery cinnamon G. not connected by veins. Pine woods. O. $3 \times 5 \times \frac{3}{4}$. Edible.

ii. Veil entirely viscid; the stem is consequently not floccoso-peronate, but viscid, with a varnished appearance when dry.

**C. nitidus** Fr. (1028).—P. *honey-coloured tan, at length whitish, disc tan*, convex, plane or depressed, glutinous, cuticle often cracking in streaks when dry; S. pallid white and fibrillose with *mealy apex, then yellowish* and naked, base clavate; Co. slightly fibrillose, fugacious; G. whitish, then clay-colour, finally watery cinnamon, *decurrent, crowded*; subcæspitose. Beech woods. R. $3\frac{1}{2} \times 3 \times \frac{1}{2}$. Edible.

**C. delibutus** Fr. (1030).—*Differs* from 1028 in its yellow P., which is slightly silky fibrillose when the gluten has disappeared, in the yellowish-white S. with white *apex and viscid up to* the Co., and the dark blue, then clay-cinnamon, adnate, subdistant G. with serrulate edge. Damp grassy places. O. $2 \times 3\frac{1}{2} \times \frac{1}{4}$. *Edible*.

**C. stillatitius** Fr. (1032) is distinguished by the P. and S. being clothed with azure-blue gluten; P. fuscous, livid, then grey-white, convexo-plane, subumbonate; G. dark cinnamon, emarginate. Pastures. O. $2\frac{1}{2} \times 3\frac{1}{4} \times \frac{1}{4}$. Edible.

## Subgenus 3. INOLOMA Fr.

Cap equally fleshy, dry, subcompact, at first silky, with innate scales or fibrils, becoming smooth; stem fleshy, somewhat bulbous; veil single, fibrillose.

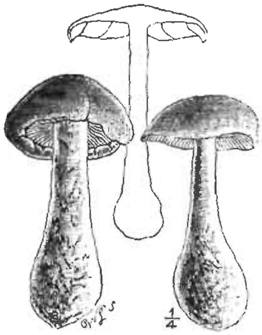

Fig. 46.—*Cortinarius (Inoloma) callisteus* Fr. ($\times \frac{1}{4}$.)

### 76. C. violaceus Fr. (1039). (Latin *violaceus*, violet.)

Cap dark violaceous, sometimes purplish violet, fleshy, convex, then flattened, regular, obtuse, covered with villose, minute, suberect tufts or scales, at length metallic shining, margin at first involute; stem dark violaceous, *stout, very* bulbous, tomentose at first, then fibrillose; cortina azure-blue, then ferruginous with the spores, woolly; gills intense violet-purple, then ferruginous from the spores, somewhat adnate, broader than *the flesh of the cap*, firm, *distant, connected* by veins; flesh blue, becoming white.

Woods, especially under birch and beech. Frequent. August to November. $4 \times 4 \times 1$. Edible.

**C. turgidus** Fr. (1038).—P. clay-colour, silvery, shining when fully grown, convexo-obtuse, hoary, margin white, silky when young; S. silvery white, stout, base very bulbous, externally cartilaginous and subreticulately cracked; Co. white, fibrillose, fugacious; G. whitish, then clay-colour, crowded, denticulate. Woods etc. O. $3 \times 2\frac{1}{2} \times \frac{3}{4}$. Edible.

**C. alboviolaceus** Fr. (1042).—Differs from 1039 in the whitish violet, innately silky P., the concolorous, then *whitish*, white, villous, clavato-bulbous S., which is fibrillose above with the Co. and often zoned in the middle, and in the greyish-lilac, then grey-cinnamon, subserrulate G. not connected by veins. Beech woods etc. C. 3×4×½. Edible.

77. **C. sublanatus** Fr. (1054). (*Latin sub*, somewhat, *lanatus*, woolly.)

Cap fawn-colour or olivaceous-fawn, becoming tan-fuscous, then *ferruginous*, slightly fleshy, campanulate, then expanded, umbonate, covered with innate, floccose, fuscous squamules; stem *pale ochraceous*, solid, conico-*elongated*, or clavato-bulbous, clad to the middle with fuscous down, which is continued into the fibrillose cortina, apex slightly violaceous, naked; *cortina* yellowish, arachnoid; gills olivaceous yellowish or ochraceous ferruginous, then cinnamon, adnate, broader behind, scarcely crowded; *flesh ochraceous* yellow, deeper coloured in the stem; smell of radish.

Coniferous woods. Uncommon. Sept. to Oct. 4×3½×¼.

**C. pholideus** Fr. (1053).—Differs from 1054 in the squamules of the P. being more compact and crowded. P. fawn-colour, becoming pale, then somewhat cinnamon; S. brownish, squarrose, with fuliginous blackish scales up to the cortinate arachnoid ring, pale violaceous *below*; G. violaceous, then clay-colour, at length pallid, subemarginate, thin, crowded; flesh pallid. Deciduous woods. C. 3×3×½. Edible.

**C. bolaris** Fr. (1052).—P. light yellow, red, or pale, variegated with *innate*, adpressed, spot-like, red scales, convexo-plane; S. pale, variegated with saffron-red, adpressed, fibrillose scales, sometimes entirely scarlet, apex *white*; G. cream-colour, *then dark cinnamon*, crowded; taste acrid. Beech woods. F. 2×2½×¼. Suspicious.

Subgenus 4. Dermocybe Fr.

Cap thin, equally fleshy, at first silky, with innate villous down, becoming smooth when old, dry; veil simple.

*a. Gills at first violaceous, becoming purple.*

78. **C. spilomeus** Fr. (1069). (Greek *spilos*, a spot—from the spotted cap.)

Cap rufescent or clay-colour, fleshy, convex, then expanded, gibbous, smooth; stem whitish-lilac, covered with rufous or tawny scales in the basal half, equal, slightly thickened at the base; cortina white, fibrillose; gills bluish grey or violaceous, becoming pale, at length watery-cinnamon, adnate or emarginate, crowded, thin; flesh cinereous, becoming white.

Woods. Uncommon. Sept. to Nov. 2×4×⅜.

**C. caninus** Fr. (1064).—P. fuscous-brown, becoming brick-rufescent, tawny when dry, convex, then plane, margin at first white, silky; S. pale white, apex violaceous, often ochraceous at the subbulbous base, fibrillose; Co. fibrillose, forming a white or fuscous zone near the apex of the S.; G. bluish or purplish, *then cinnamon*, emarginate, subdistant, thin; taste mild. Deciduous woods etc. C. 3½×4×¾. Edible.

Fig. 47.—*Cortinarius (Dermocybe) cinnamomeus* Fr.

**C. myrtillinus** Fr. (1065).—P. fuliginous, tinged with lilac, becoming hoary-silky, convex, gibbous, becoming plane; S. whitish, streaked with sparse lilac fibrils, subbulbous; Co. white, fibrillose; G. pure amethyst-azure-blue, adnate, subdistant, edge whitish and denticulate. Woods. F. $3 \times 2\frac{1}{2} \times \frac{3}{8}$. Edible.

Colour and habit of *Tricholoma nudum* (139).

**C. azureus** Fr. (1066).—P. lilac, becoming hoary, then fuscous and pallid, convex, then plane, silky, shining, atomate; S. sky-blue, becoming whitish, thickened at the base, silky, striate, often twisted; Co. concolorous; G. bright bluish-violet, adnato-emarginate, rather crowded. Beech woods. G. $1\frac{3}{4} \times 2 \times \frac{1}{4}$. Edible.

*b.* Gills bright cinnamon, red, or yellow; stem and fibrillose cortina coloured.

79. **C. cinnamomeus** Fr. (1075). (Greek *cinnamonon*, cinnamon.) Cap somewhat cinnamon or tawny-ochraceous, fleshy, convex, then expanded, obtusely umbonate, silky, or squamulose with innate yellowish fibrils, finally becoming smooth; stem yellowish, equal, fibrillose; cortina yellowish, fibrillose; gills yellowish, then cinnamon, adnate, broad, thin, crowded, shining; flesh yellowish.

Woods. Common. Aug. to Feb. $3 \times 3\frac{1}{2} \times \frac{1}{4}$.

The var. *semisanguineus* differs principally in its thick blood-red G.

**C. miltinus** Fr. (1071).—P. bay-brown cinnamon to brick-red, convexo-expanded, flexuose, fibrillosely silky; S. pale, reddish-fibrillose below, striate; Co. red-fibrillose; G. reddish, then ferruginous. Woods. C. $1\frac{3}{4} \times 1\frac{1}{2} \times \frac{1}{4}$.

**C. cinnabarinus** Fr. (1072).—P. scarlet, campanulato-flattened, silky, then smooth and shiny; S. concolorous, fibrillose or striate; Co. cinnabar, fibrillose, lax; G. concolorous, often connected by veins, edge unequal and darker; smell of radish. Beech woods. F. $2 \times 3 \times \frac{1}{4}$.

**C. sanguineus** Fr. (1073).—Wholly blood-red. P. convexo-plane, shaggy or squamulose; S. flexuose, fibrillose, base sometimes white; Co. arachnoid, fugacious; flesh exuding a blood-red juice when pressed; smell of radish. Coniferous woods. F. $2 \times 2 \times \frac{1}{4}$.

Subgenus 5. Telamonia Fr.

Cap thinly fleshy or abruptly thin at the margin, moist, hygrophanous, smooth, or sprinkled with whitish superficial fibres, the remains of the veil; stem annulate from the inferior veil or peronate with scales, somewhat cortinate at the apex.

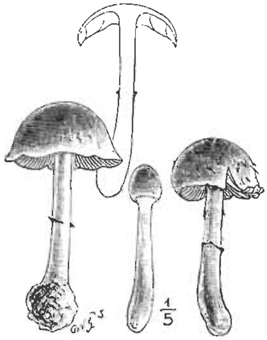


Fig. 48.—*Cortinarius* (*Telamonia*) *armillatus* Fr.

80. **C. bulbosus** Fr. (1089). (Latin *bulbosus*, bulbous.)

Cap date-brown, becoming fuscous brick-red when dry, fleshy, campanulato-expanded, obtuse or broadly gibbous, even, or fibrillosely squamulose towards the margin from the torn epidermis; stem paler than the cap, becoming whitish, tinged saffron-yellow at the bulbous base, solid, equal; cortina white, sheathing, forming a fugacious ring; gills dark, then brown-cinnamon, adnate, broad, subdistant; flesh concolorous and pallid when damp, tinged with saffron-yellow at the base of the stem; smell none, or of radish.

Woods. Uncommon. Sept. to Oct. $3\frac{1}{4} \times 4 \times \frac{1}{2}$.

**C. torvus** Fr. (1093).—P. brick-colour, date-brown, or copper-brown, convex, then flattened, sprinkled with hoary squamules and fibrils, then smooth; S. whitish, then discoloured, short and bulbous, then elongated and subequal, sheathed, fibrillose and floccosely scaly to the middle, forming a white, membranous, persistent R., apex pale violaceous and silky, base white, villous; Co. white, villous, then fibrillose; G. violaceous, soon purplish-umber, then dark cinnamon, very broad, thick, distant; smell disagreeable. Beech woods. C. $5 \times 5 \times \frac{3}{4}$. Edible.

**C. impennis** Fr. (1094).—Differs from 1093 in the absence of a sheathing base to the S., the Co. forming an incomplete white zone towards the apex. P. umber, then brick-colour, smooth, very obtuse, margin silky at first, at length cracked; G. intense bright violaceous, soon becoming watery ferruginous. Pine woods. O. $4\frac{1}{2} \times 5 \times 1$. Edible.

81. **C. evernius** Fr. (1097). (Latin *evernius*, sprouting—from the long stem.)

Cap purple bay-brown, brick-colour when dry, becoming isabelline, hoary when old, very hygrophanous, fleshy, very thin at the margin, conico-campanulate, then flattened, obsoletely umbonate, adpressedly silky, then smooth, at length rimosely incised and torn into fibrils, fragile; stem violaceous, becoming pale, then cinnamon, adnate, ventricose, very broad, distant; flesh concolorous in the cap, violaceous in the stem; smell like that of *Psalliota campestris*.

Woods. Uncommon. Sept. to Dec. $2\frac{1}{4} \times 5 \times \frac{1}{2}$.

**C. armillatus** Fr. (1099) (*C. hæmatochelis* Fr., 1100).—P. red or fuscous brick-colour, cylindrical, then campanulate, flattened, smooth, then innately fibrillose or squamulose, margin at first incurved; S. white, becoming brownish with age, striate when old, with one to four distant, oblique, cinnabar zones formed by the veil, base bulbous and reddish-fibrillose; Co. reddish white, fibrillose; G. pallid cinnamon, then dark ferruginous, very broad, distant; smell of radish or none. Woods etc. C. $5 \times 6 \times \frac{1}{2}$. Edible.

82. **C. gentilis** Fr. (1105). (Latin *gentilis*, of the same race—from its resemblance to its neighbours.)

Cap tawny-cinnamon, yellow when dry, very hygrophanous, fleshy, thin at the margin, conico-expanded, then flattened, acutely umbonate, rimosely incised, often somewhat silky; stem concolorous, stuffed, then hollow, equal or attenuated at the base, often curved, fibrillose, furnished with one or more oblique, yellow, annular zones formed by the veil, sometimes floccoso-scaly below the ring, base white, tomentose; gills yellow, then tawny-cinnamon, adnate, thick, very distant, often connected by veins; flesh concolorous.

Gregarious in woods, especially pine, and heaths. Frequent. Aug. to Oct. $3 \times 4 \times \frac{3}{8}$.

**C. hinnuleus** Fr. (1104).—Differs from 1105 in the obtuse P. being shining when dry, and having the margin at first silky and white, in the dingy tawny S. being white silky with the adpressedly silky veil and white-zoned above, in the ochraceous, then tawny, ferruginous, thin G., and the strong smell. Woods etc. C. $3 \times 4 \times \frac{3}{8}$.

**C. glandicolor** Fr. (1113).—P. brown or cinnamon-brown, tan or isabelline when dry, submembranous, conico-expanded, soon glabrous, margin striate when moist, sprinkled with thin, short, white fibrils when dry; S. concolorous, then date-brown fuscous, fibrillosely striate, veil forming a woven, white, distant, fugacious R.; G. concolorous or umber, very distant, somewhat thick. Pine woods. O. $1\frac{1}{2} \times 3 \times \frac{3}{16}$.

**C. hemitrichus** Fr. (1123).—P. dark fuscous, fuscous-tan when dry, umbo generally persistently dark, fleshy, convexo-expanded, covered wholly or only round the margin with white, fibrillose, curled, erect, superficial flocci, then smooth;

S. smooth, white, flocculose below the shining, white, median, often membranous and reflexed R.; G. clay-colour, then cinnamon, very crowded. Woods etc. C. $2 \times 3 \times \frac{1}{4}$.

**C. rigidus** Fr. (1125).—P. bay-cinnamon, pale yellow or fuscous-tan when dry, conico-campanulate, then expanded, at length depressed round the umbo, smooth, becoming scaly when fully grown, margin silky at first from the white veil, then pellucidly striate; S. concolorous, adpressedly fibrillose, girt with the squamose white veil; R. white, floccose; G. cream, then cinnamon; smell strong. Woods etc. C. $1\frac{1}{2} \times 3 \times \frac{3}{16}$.

**C. palæaceus** Fr. (1126).—P. fuscous, dingy when dry, very hygrophanous, conical, then expanded, umbonate, silky with white superficial squamules, the remains of the veil, then smooth, opaque; S. concolorous, tough, squamulose with white flocci, base white-villose; R. white, fibrillosely floccose, fugacious; G. pallid whitish, then cinnamon, crowded. Woods. F. $1\frac{1}{2} \times 3 \times \frac{1}{8}$.

## Subgenus 6. Hydrocybe Fr.

Cap thinly fleshy, moist, hygrophanous, smooth, or innately silky; stem not sheathed, annulated, nor scaly.

**C. castaneus** Fr. (1140). P. fuscous-chestnut, becoming pale and silky when dry, shining, umbo becoming black, paler at the slightly scalloped margin and often white silky with the Co., fleshy, firm, campanulato-flattened, often irregular; S. pallid violaceous or pallid rufescent, cartilaginous, slightly fibrillose with the veil: Co. white, fibrillose, scanty; G. violaceous, then ferruginous, thin, crowded, edge often whitish; sometimes cæspitose. Woods etc. $1\frac{3}{4} \times 2\frac{3}{4} \times \frac{3}{16}$. Edible.

**C. leucopus** Fr. (1155).—P. pale yellow, tan and shining when dry, conical, then expanded, umbonate, moist; S. shining white, soft: Co. white, median; G. pallid, then cinnamon, ventricose, crowded, thin. Woods etc. C. $1\frac{1}{4} \times 1\frac{1}{2} \times \frac{3}{16}$.

**C. erythrinus** Fr. (1157).—P. bay-brown rufous, tawny when dry, umbo darker, conical, then convex; S. shining silvery white, violaceous upwards, fibrillosely striate, apex often pruinose; Co. white, superior, fibrillose: G. pallid, then pale cinnamon, ventricose, thin, subdistant. Woods. F. $1 \times 2 \times \frac{1}{16}$. Edible.

**C. decipiens** Fr. (1158). P. bay-brown, shining and brick-colour when dry, acute umbo darker, campanulato-expanded, at length depressed round the umbo, margin finally striate and torn; S. pallid, pale rufescent, or with brick-coloured spots, tense, fibrillose, covered with a pallid separable cuticle; Co. white, fibrillose, very fugacious; G. brick-colour, ferruginous, thin. Woods. C. $2\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{4}$.

**C. acutus** Fr. (1163). P. honey-colour to pale yellow, somewhat shining, tan or white when dry, conical, then campanulate and expanded, acutely umbonate, at length depressed round the umbo, striate when moist, margin subfibrillose, then smooth; S. concolorous, flexuose, white fibrillose, then smooth; Co. white, fibrillose, adhering to the margin of the P.: G. ochraceous cinnamon, lanceolate, thin, crowded, becoming subdistant. Woods etc. C. $1\frac{1}{4} \times 2\frac{1}{2} \times 4$.

# XLIV. GOMPHIDIUS Fr.

(Greek *gomphos*, a large bolt or nail—from the shape.)

The cap is fleshy, regular, viscid, and finally turbinate in shape; the stem is imperfectly floccoso-annulate or cortinate; the gills are mucilaginous, decurrent, distant; the spores are blackish and fusiform. The species grow on the ground in coniferous woods. There are four British species.

*Gomphidius* is somewhat similar to *Hygrophorus* in structure, but differs in the cortinate stem and blackish fusiform spores.

83. **G. glutinosus** Fr. (1168). (Latin *glutinosus*, glutinous.)

Cap purple-fuscous or fuscous, often mottled with black, fleshy, convex, obtuse, then plane or slightly depressed, smooth, very glutinous; stem whitish, slightly thickened and yellow at the

base, glutinous, fibrillose, sometimes black scaly; cortina annular, fugacious; gills whitish, then cinereous, deeply decurrent, forked, distant, mucilaginous; flesh white, yellow towards the base of the stem; taste bitter.

Coniferous woods. July to Nov. Common. $4 \times 3\frac{1}{2} \times \frac{1}{2}$. Edible.

Var. *roseus* is distinguished by its rose-coloured or dark cinnamon-red, slightly glutinous P., its white S. often tinged rose at the base, and its whitish, cinereous, then olivaceous G.

84. **G. viscidus** Fr. (1169). (Latin *viscidus*, viscid.)

Cap fuscous-rufous, compact, campanulate, then expanded, umbonate, slightly viscid, paler and shining when dry; stem somewhat *paler in colour, yellowish at the base, equal or attenuated downwards*, fibrillosely scaly, slightly viscid; cortina floccose, forming a fugacious ring; gills olivaceous, then fuscous-purple, deeply decurrent, distant, often branched, edge often paler; flesh yellowish, often with purple stains.

Coniferous woods. Common. July to Dec. $5 \times 4\frac{1}{2} \times 1$. Edible.

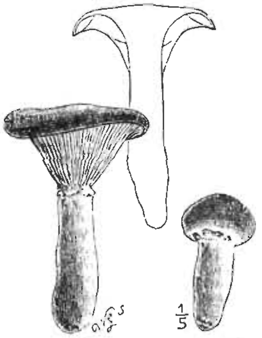


Fig. 49.—*Gomphidius viscidus* Fr. ($\times \frac{1}{5}$.)

Fig. 50.—*Paxillus involutus* Fr. ($\times \frac{1}{4}$.)

**G. maculatus** Fr. (1170).—P. reddish brown, disc paler, often black-spotted, becoming black at the margin; S. white, yellow at the base, blackening when touched, floccose; G. white-cinereous, then olivaceous. Coniferous woods. O. $2\frac{1}{4} \times 2\frac{1}{2} \times \frac{1}{2}$. *Edible.*

**G. gracilis** B. & Br. (1171).—Differs from 1170 in its slender habit, in the S. being white scaly above and yellow virgate below, and in the G. showing short tomentose hairs under a lens. Coniferous woods. $2 \times 2\frac{1}{4} \times \frac{1}{4}$. Edible.

## XLV. PAXILLUS Fr.

(Latin *paxillus*, a small stake or peg—from the shape.)

The cap is fleshy with the margin at first involute; the stem is central, excentric, lateral, or absent; the gills are decurrent, often anastomosing behind and forming spurious pores, soft, almost mucilaginous, readily separating from the hymenophore; the spores are whitish to ferruginous. The species grow on the ground or on wood. There are about fifteen British species. Some of the members

of the white-spored forms (*Lepista*) are allied to *Tricholoma* and *Clitocybe*; those with ferruginous spores (*Tapinia*) to *Flammula*.

i. Pileus usually excentric or resupinate; spores ferruginous (*Tapinia*).

85. **P. involutus** Fr. (1181). (Latin *involutus*, inrolled.)

Cap ochrey ferruginous, fleshy, convexo-plane, then depressed, sometimes excentric, pubescent, soon becoming smooth, subviscid when moist, shining when dry, margin obtuse, viscid, villous, closely involute, then extended and acute; stem dingy yellowish, generally spotted, thickened upwards, sometimes bulbous at the base, naked; gills pallid, then ferruginous, immediately dingy-spotted when touched, decurrent, rather broad, branched behind, and often anastomosing and forming pores near the stem; flesh pallid or yellowish; taste mild.

Woods, heaths, and pastures. Common. June to Dec. 7×3×1. Edible.

A white, then brilliant yellow mould, *Hypomyces (Sepedonium) chrysospermus* (see p. 194), is frequently parasitic on the gills of this species.

**P. paradoxus** Berk. (1180).—P. deep rufous umber or yellowish brown, adpressedly tomentose, becoming smooth, dry, margin often lobed and sinuate; S. yellow, often tinged dingy purple, somewhat rooting, adpressedly fibrillose, the cuticle often breaking up into squarrosely revolute flaps; G. yellow, then golden, reddish when bruised, distant, veined, sometimes anastomosing to form pores towards the margin. Woods etc. O. 4×1½×¾. Edible.

**P. atrotomentosus** Fr. (1183).—P. ferruginous, excentric, dry, rivuloso-granular, sometimes subtomentose, margin thin and involute; S. covered with dense umber-blackish or somewhat violaceous velvety down, curved, rooting; G. yellowish, subdecurrent, branched at the base, somewhat anastomosing. Coniferous woods. F. 6×2¼×1½. Edible.

**P. panuoides** Fr. (1185).—Wholly dingy yellow. P. sessile or extended, resupinate at first, then conchato-dimidiate, often imbricated, finally undulato-lobed, pubescent, then smooth, somewhat rivulose. G. yellow, decurrent to the base, anastomosing behind, branched, crisped, crowded; smell often fragrant. Saw dust, rotten pine stumps, etc. F. 4 in. diam. Edible.

ii. Pileus entire, central; spores dirty white (*Lepista*).

**P. giganteus** Fr. (1172).—Wholly tan-white. P. fleshy, convex, then plano-infundibuliform, minutely adpressedly squamulose, often guttate, margin at first strongly involute and pubescent, then spreading and smooth, finally revolute and sulcate with small shallow channels, often splitting; S. smooth or minutely pubescent, base subbulbous; G. whitish, then tan, subdecurrent, very crowded; smell pleasant. Pastures etc. F. 1-12×4×1. Edible.

**P. extenuatus** Fr. (1175).—P. clay or becoming fuscous tan, convex, gibbous, then expanded, margin pubescent, rigid, fragile; S. pallid, somewhat horny, fibrillose, subclavate, rooting, the mycelium compacting the earth into a large ball; G. whitish to mouse-colour, arcuate, very narrow, linear, very crowded. Grassy places in pine woods. R. 4×2×¾. Edible.

## XLVI. HYGROPHORUS Fr.

(Greek *hugros*, moist, *phero*, to bear.)

The chief characteristic of *Hygrophorus* is that the gills are waxy; the cap is fleshy and frequently glutinous or viscid; the gills are decurrent or adnato-decurrent, usually distant and thick, but acute

at the edge, often branched and veined; the spores are white, rarely slightly coloured. The species are almost without exception terrestrial. There are about seventy British species; most are edible, probably none are harmful.

*Hygrophorus* differs from *Cortinarius*, *Gomphidius*, and *Paxillus* in the colour of the spores, from *Lactarius* in being non-milky, from *Russula* in not being vesiculoso-rigid, and from *Cantharellus* in the sharp-edged gills.

Fig. 51.—*Hygrophorus pratensis* Fr. (× $\frac{1}{3}$.)

i. Universal veil viscid, with occasionally a floccose partial veil, which is annular or marginal; stem clothed with minute scales or rough with dots above.

*a.* White or yellowish white.

86. **H. eburneus** Fr. (1188). (Latin *eburneus*, ivory-white.)

Entirely shining white, becoming yellowish with age. Cap convexo-plane, flat, somewhat repand, margin at first involute and pubescent, very glutinous in rainy weather; stem stuffed, then hollow, equal or nearly so, glutinous, apex granular; gills decurrent, distant, veined; smell mild, pleasant.

Woods and pastures. Aug.–Nov. $2\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$. Edible.

**H. chrysodon** Fr. (1187).—Differs from 1188 in the white or yellowish P. having evanescent yellow, floccose squamules, in the S. being covered with minute light yellow squamules which form a zone at the apex, and in the G. edge being frequently yellowish. Woods. F. $3 \times 3\frac{1}{2} \times \frac{1}{2}$. Edible.

87. **H. cossus** Fr. (1189). (*Cossus ligniperda*, goat-moth.)

Cap white, disc ochraceous, convexo-plane, obtuse, very glutinous, margin naked; stem tinted faintly ochraceous, often slightly attenuated downwards, granular at the apex; gills decurrent, distant, thick, connected by veins; smell powerful, like that of goat-moth (*Cossus ligniperda*) larvæ.

Woods. Aug.–Nov. $3 \times 4 \times \frac{1}{2}$. Suspicious.

**H. penarius** Fr. (1190).—P. white, then tan-colour, convexo-expanded umbonate, obtuse, then flat; S. whitish, often yellowish at the fusiform rooting

base; G. white or tan, covered with a quickly drying gluten, scabrous. Oak woods. O. $4 \times 3 \times \frac{3}{4}$. Edible.

*b*. Reddish.

**H. erubescens** Fr. (1192).—P. whitish, dotted with pink or red scales, gibbous, then convexo-plane; S. whitish, red-fibrillose, yellowish when bruised; G. whitish, then red-spotted or shaded rose; taste bitter. Coniferous woods. $4 \times 3\frac{1}{2} \times \frac{3}{4}$. Edible.

**H. pudorinus** Fr. (1193).—P. salmon-rose, disc darker, convex, then depressed, margin white and pubescent; S. white or salmon-rose, viscid, apex contracted and floccoso-granulose; G. white, edge salmon; smell pleasant, taste sweet. Coniferous woods. O. $4 \times 3 \times \frac{3}{4}$. Edible.

*c*. Tawny or light yellow.

**H. arbustivus** Fr. (1195).—P. fawn-tan, pubescent, margin paler, innato-fibrillose, umbonate: S. white, viscid, apex with white, free, mealy granules; G. white; smell and taste pleasant. Woods. F. $2\frac{1}{4} \times 2 \times \frac{1}{4}$. Edible.

**H. discoideus** Fr. (1197).—P. pale yellowish, disc reddish brown, very glutinous, campanulate, then plane, obtusely umbonate; S. white, viscid, flocculose, apex punctate; G. faint yellowish-tan or flesh-colour. Woods. F. $2\frac{1}{2} \times 3 \times \frac{1}{4}$. Edible.

**H. aureus** Arrh. (1196).—P. golden yellow or bright orange; S. pale sulphur above, yellow below, sometimes annulate with the fugacious, glutinous, reddish veil; G. white to deep sulphur. Woods. R. $1\frac{1}{2} \times 2 \times \frac{1}{4}$. Edible.

*d*. Olivaceous umber.

88. **H. hypothejus** Fr. (1201). (Greek *hupo*, under, *theion*, sulphur—from the sulphur-colour under the gluten.)

Cap covered at first with olivaceous gluten, then cinereous, pale and yellowish, orange, or rarely rufescent, fleshy, convex, then depressed, somewhat streaked; stem yellow-greenish, then yellow, sometimes flesh-colour, stuffed to hollow, equal or attenuated downwards, viscid, fugaciously subannulate, the fugitive partial veil being at first floccose, cortinate and annular; gills pallid whitish, soon yellow or flesh-colour.

Coniferous woods and heather. Common. Sept. to Dec. $3 \times 3 \times \frac{1}{2}$. Edible.

**H. olivaceoalbus** Fr. (1200).—P. olive-brown, becoming pale especially towards the margin, conical, then expanded, umbonate, glutinous, often forming tear-like drops at the finally striate margin; S. white, sheathed below with the spotted, squamulose, fuscous, viscid veil, which forms a R., apex shining white; G. white or olivaceous from the gluten. Coniferous woods. C. $3 \times 4 \times \frac{1}{2}$. Edible.

*e*. Fuscous-cinereous or livid.

**H. fuscoalbus** Fr. (1203).—P. brownish, becoming cinereous, convexo-plane, margin white, floccose; S. white, floccose at the apex when dry; G. white. Woods. O. $1\frac{1}{2} \times 2 \times \frac{1}{4}$. Edible.

**H. agathosmus** Fr. (1204).—P. livid grey, whitish papillate, convexo-plane, gibbous, margin involute and villose at first; S. white, somewhat fibrillosely striate; G. white, granularly farinose at the apex, the squamules becoming greyish; odour of anise. Coniferous woods. F. $3 \times 2 \times \frac{3}{8}$. Edible.

**H. pustulatus** Fr.—P. grey, disc fuscous, papillate, convex, then expanded; S. white, black punctate; G. white or glaucous. Fir woods. O. $1\frac{3}{4} \times 1\frac{1}{2} \times \frac{1}{2}$. Edible.

ii. Veil none; stem even, smooth, or fibrillose; pileus firm, opaque, moist, not viscid: gills distant, arcuate.

*a.* Gills deeply and at length obconically decurrent.

89. **H. pratensis** Fr. (1210). (Latin *pratensis*, growing in meadows.)

Cap tawny yellow or buff, very fleshy at the disc, thin at the margin, convex, then flattened, smooth, moist in rainy weather, often cracked in dry weather: stem concolorous, but paler, broadened upwards from the base and dilated into the cap, thus giving the latter a turbinate appearance: gills at first arcuate, then decurrent, very distant, thick, firm, brittle, connected by veins; flesh white or tinged like the cap.

Pastures and downs. Common. Aug. to Dec. $4 \times 2\frac{1}{2} \times \frac{3}{4}$. Edible.

**H. caprinus** Fr. (1207).– P. blackish or blackish fuliginous, then dark grey, streaked, fibrillose, convex, then plane and depressed, margin white, pruinose, and incurved at first: S. fuliginous, longitudinally fibrillose, apex finally whitish, base white and pubescent; G. white, becoming glaucous; smell strong. Heaths etc. O. $3 \times 4 \times \frac{1}{2}$. Edible.

**H. leporinus** Fr. (1208).– P. reddish yellow, varying fuscous, fibrilloso-floccose, convex, gibbous, margin scalloped, then split: S. whitish flesh-colour, fibrillose, base white: G. pale yellowish. Woods etc. R. $3 \times 2\frac{1}{2} \times \frac{1}{2}$. Edible.

**H. nemoreus** Fr. (1209).– P. orange, convexo-expanded, gibbous, then depressed: S. pale biscuit-colour, squamulose, piloso-striate: G. somewhat concolorous. Woods etc. O. $2\frac{3}{4} \times 2 \times \frac{1}{2}$. Edible.

90. **H. virgineus** Fr. (1212). (Latin *virgineus*, maidenly.)

Entirely white. Cap fleshy, convex, then plane, at length depressed, often floccose, widely fissured and cracked when dry; stem stuffed, firm, attenuated at the base, pruinose, striate; gills decurrent, distant, rather thick; smell and taste pleasant.

Pastures, heaths, and woods. Common. Aug. to Dec. $2 \times 2 \times \frac{1}{4}$. Edible.

Sometimes shaded violet, owing to attack by *Verticillium Marquandii* (Hyphomycete).

**H. niveus** Fr. (1214). Differs from 1212 in being thinner, in its umbilicate P., being striate when moist, and in its equal S. and thinner G. Heaths etc. C. $1 \times 2 \times \frac{1}{16}$. Edible.

**H. russocoriaceus** Berk. & Mill. (1216).– Wholly white; can be distinguished by its arched, thick, and sparse G., and its smell like that of Russian leather. Pastures etc. F. $1 \times 1 \times \frac{1}{4}$. Edible.

Dried specimens in the Department of Botany have retained their smell for fifty years.

*b.* Gills ventricose, sinuato-arcuate, or plano-adnate.

**H. ovinus** Fr. (1222).– P. brownish or subochraceous, campanulate, then revolute, subviscid, then slightly squamulose, rimosely incised; S. pallid or greyish, curved or twisted, fibrillosely striate; G. grey, then rufescent; smell strong of meal. Pastures etc. F. $2\frac{1}{4} \times 2\frac{1}{2} \times \frac{1}{2}$. Edible.

iii. Veil none; pileus viscid when moist, shining when dry, rarely floccoso-scaly; stem hollow, soft, not punctate; gills soft. Whole fungus thin and watery, succulent, fragile, mostly brightly coloured and lustrous.

*a.* Gills decurrent.

91. **H. ceraceus** Fr. (1230). (Latin *ceraceus*, waxy.)

Wholly waxy yellow. Cap convexo-plane, pellucid and shining, viscid, margin pellucidly striate; stem often unequal, flexuose, hollow, compressed, smooth; gills adnato-decurrent, almost triangular, connected by veins; flesh concolorous.

Woods, pastures, and downs. Common. Sept. to Dec. $1\frac{1}{2} \times 3 \times \frac{1}{8}$. Edible.

**H. coccineus** Fr. (1231).—P. bright scarlet, changing to yellowish, convex, then plane, obtuse; S. similarly changing colour, compressed, base always yellow; G. purplish at the base, yellow in the middle, and glaucous at the edge, trama red. Woods etc. C. $2\frac{3}{4} \times 2\frac{3}{4} \times \frac{1}{2}$. Edible.

**H. miniatus** Fr. (1232).—P. vermilion, becoming pale, opaque, convex, then umbilicate, sometimes squamulose; S. concolorous, shining; G. yellow or yellow-vermilion; flesh reddish, then yellow. Heaths etc. C. $1 \times 2 \times \frac{1}{8}$.

**H. Reai** Maire.—Differs from 1232 in its viscid S., bitter taste, and orange flesh. Woods etc. F. $1 \times 2 \times \frac{1}{8}$.

*b.* Gills adnexed, somewhat separating.

92. **H. puniceus** Fr. (1235). (Latin *puniceus*, blood-red.)

Cap deep shining blood-red, becoming variegated whitish-crimson in dry weather, slightly fleshy, campanulate, then flattened, irregular, and lobed; stem concolorous and variegated, white at the base, stout, solid, then hollow, ventricoso-striate, squamulose at the apex; gills whitish yellow or reddish yellow at the base, ascending, ventricose, adnexed, almost free, thick, distant; flesh concolorous.

Pastures, downs, woods. June to November. Common. $4 \times 5 \times 1$. Edible.

**H. obrusseus** Fr. (1236). P. golden sulphur-yellow, with a tinge of green, campanulate, then expanded and somewhat areolate, lobed and often splitting at the margin; S. sulphur-yellow, becoming tawny at the base; G. white, tinged yellowish green towards the base, very broad. Woods etc. F. $2\frac{1}{2} \times 4 \times \frac{3}{4}$. Edible.

**H. intermedius** Pass. (1237).—P. golden yellow, becoming greyish, campanulate, then expanded, very thin, fibrillosely silky; S. yellow, fibrillosely striate; G. whitish, then yellow; smell of meal. Grassy places. O. $2\frac{1}{2} \times 2\frac{3}{4} \times \frac{1}{4}$. Edible.

93. **H. conicus** Fr. (1238). (Latin *conicus*, conical.)

Cap varying in colour from scarlet, through ochre, to whitish sulphur, greenish, and livid, somewhat membranous, often acute, commonly lobed, then expanded and cracked, smooth, viscid when moist, shining when dry; stem concolorous or yellow, reddish at the base, equal, fibroso-striate, twisted, extremely fragile; gills white or yellow, sometimes reddish at the base, attenuato-free, ventricose, thin, somewhat crowded; flesh concolorous, becoming black.

Pastures, downs, woods. July to November. Common. $3 \times 3\frac{1}{2} \times \frac{2}{5}$. Suspicious.

All parts of the fungus become black on being touched or broken. The whole plant generally blackens shortly after reaching maturity, except in dry weather.

**H. calyptræformis** B. & Br. (1239) is distinguished by its rose, then pallid, P., white substriate S., and pink G.; P. acutely conical, then expanded and revolute, minutely innato-fibrillose. Pastures etc. F. $3 \times 4 \times \frac{3}{8}$. Edible.

**H. chlorophanus** Fr. (1240).—Entirely rich yellow, becoming paler, viscid; P. convex, then plano-depressed, at length cracked, often striate; G. white at first, very ventricose. Pastures etc. C. $2 \times 3 \times \frac{1}{4}$. Edible.

94. **H. psittacinus** Fr. (1241). (Latin *psittacinus*, pertaining to a parrot.)

Wholly covered with green gluten when young. Cap bright yellow, whitish, or pinkish, variegated with a bright green gluten, campanulate, then expanded, smooth, umbonate, becoming paler in colour and less viscid with age; stem concolorous and wholly greenish from the gluten or only at the apex, hollow, equal, somewhat tough; gills yellow, green at the base, adnate, ventricose, rather thick, broad, somewhat distant.

Down and pastures. Common. July to November. $2\frac{1}{4} \times 3 \times \frac{1}{4}$. Edible.

## XLVII. LACTARIUS Fr.

(Latin *lac*, milk.)

$\frac{1}{3}$

Fig. 52.—*Lactarius subdulcis* Fr. ($\times \frac{1}{3}$.)

*Lactarius* is characterised by all parts of the fungus exuding white or coloured "milk" when cut or broken. The milk is usually densely granular, and is of a resinous nature; it varies in taste from mild to intensely acrid. The cap is fleshy and regular; the stem is very rarely excentric; the gills are adnate or decurrent, subrigid, with acute edge and vesiculose trama; the spores are white or yellowish, rarely pinkish in the mass. The species are almost invariably terrestrial. There are about seventy British species. All mild forms are reputed to be edible: probably the acrid forms only cause discomfort when insufficiently cooked.

i. Gills not changing colour nor pruinose; milk white at first, usually acrid.

*a.* Pileus viscid when moist; margin at first involute and tomentose.

95. **L. torminosus** Fr. (1247). (Latin *torminosus*, griping.)

Cap pallid flesh or strawberry-colour, sometimes pale ochraceous or white, somewhat fleshy, convex, then depressed, and finally infundibuliform, viscid when moist, zoned, with a shaggy fibrillose, buffish or whitish, at first involute margin; stem pale flesh-colour, stuffed, then hollow, equal or attenuated downwards, sometimes pitted, delicately tomentose, then smooth; gills paler than the cap, adnato-decurrent, thin; flesh pallid; milk white, acrid.

Mixed woods and heaths. Common. Aug. to Nov. $6 \times 2 \times 1$. Suspicious.

*Hypomyces torminosus* is frequent on the gills (see p. 194).

**L. scrobiculatus** Fr. (1245).—Differs from 1247 in its yellow P. covered with agglutinated down, its light yellow subviscid S. pitted with darker yellow, broad, roundish, depressed spots, and pubescent base, its white flesh becoming yellow when broken, and its white milk becoming sulphur-yellow. Woods. F. $9 \times 2\frac{1}{2} \times 1\frac{1}{2}$. Suspicious.

**L. cilicioides** Fr. (1248).—Differs from 1247 in its conspicuously woolly, not zoned P., with long and intricately matted hairs and fibrils; milk white or light yellow. Pine woods. F. 6×2½×1½. Edible.

**L. controversus** Fr. (1251).—Differs from 1247 in having the P. dotted with blood-red spots or zones and in the very crowded G. Woods and pastures. F. 8×3×2. Edible.

**L. pubescens** Fr. (1252).—Differs from 1247 in the zoneless P. with downy margin and in the more slender habit. Woods etc. C. 4×1¾×¾.

**L. turpis** Fr. (1250).—P. umber or olivaceous, convex, then depressed, margin at first villose, olivaceous light yellow, then densely rivuloso-sulcate; S. pallid or dark olivaceous, apex ochraceous whitish, often viscid and pitted; G. light straw-colour, shaded fuscous where bruised, very crowded; milk and flesh white, acrid. Woods etc. C. 8×2½×1. Edible.

**L. aspideus** Fr. (1253) is distinguished by being wholly straw-colour, sometimes tinged lilac, with white milk and flesh becoming lilac, acrid. P. convexo-depressed, viscid, with incurved white tomentose margin, which becomes smooth; S. viscid. Damp meadows. O. 3×1½×½. Edible.

*b.* Pileus viscid when moist, pelliculose, margin usually naked.

96. **L. blennius** Fr. (1257). (Greek *blennos*, mucus—from the shining cap.)

Cap pallid olivaceous or æruginous grey, fleshy, plano-depressed, glutinous, often concentrically guttate or somewhat zoned, margin at first incurved or slightly downy; stem pallid olive or pallid grey, stuffed, then hollow, equal or attenuated downwards; gills white, becoming cinereous when bruised, thin, crowded; flesh white, becoming grey; milk white, then grey, acrid.

Woods, especially beech. Common. July to Nov. 4×1¼×1. Edible.

**L. insulsus** Fr. (1254).—Has the habit of *L. deliciosus* (No. 100), but differs in the paler colours, acrid taste, and white unchangeable milk. P. yellowish brick-colour, zoned, umbilicate, then deeply infundibuliform; S. white to pallid, often scrobiculate; G. white, then pallid, very crowded, forked; smell pleasant. Woods etc. C. 4×1½×1. Edible.

**L. zonarius** Fr. (1255).—Differs from 1254 in its pale orange to yellow, beautifully zoned P., minutely ruguloso-floccose first at the thin, for a long time involute, margin, in the whitish, then yellowish, not branched G., which become dingy when bruised, and the strong smell. Woods etc. O. 4×1½×1. Edible.

**L. hysginus** Fr. (1258).—P. reddish flesh-colour or reddish brown, umbilicate, becoming plane, often zoned or spotted, margin thin and inflexed; S. ochraceous, cream, or flesh-colour, somewhat pitted or spotted rose, pruinose, apex constricted, base attenuated; G. white to yellow-ochreous, crowded, branched; milk white, slowly acrid. Woods. O. 3×2×¾. Edible.

**L. trivialis** Fr. (1259).—Differs from 1258 in its pale yellow or pinky-tan, convex, then depressed and infundibuliform P., its hollow slippery S. somewhat paler than the P., and its whitish to pale yellowish G.; milk white, sometimes becoming yellow, acrid. Coniferous woods etc. O. 6×3×¾. Edible.

**L. circellatus** Fr. (1260).—P. rufous to fuscous, becoming paler, variegated with darker zones, convexo-plane, then depressed, umbilicate; S. whitish or yellowish, tough; G. whitish, then yellowish, horizontal, thin, crowded, often forked; milk white, acrid. Woods etc. O. 4×2×¾. Edible.

**L. uvidus** Fr. (1261).—P. cinereous with a lilac tinge or livid brownish grey, convexo-plane, then depressed; S. whitish, then light yellow, sometimes spotted yellow ferruginous or pitted, viscid; G. whitish or yellowish, becoming lilac when bruised, thin, crowded, very unequal, somewhat branched; milk and flesh white, then lilac, acrid. Woods etc. F. 4×3×½. Suspicious.

**L. flavidus** Boud. Differs from 1261 in its pale citron or sulphur yellow P., which stains violet when bruised, and from *L. aspideus* (1253) in the naked expanded margin of the P. and the non-viscid S.: milk and flesh white, then violet. Woods. O. 4×3×¾. Suspicious.

c. Pileus without a pellicle, dry, usually not shining.

97. **L. pyrogalus** Fr. (1263). (Greek *pur*, fire, *gala*, milk—from the acrid milk.)

Cap cinereous grey, finally becoming dingy yellow, firm, convex, becoming plane, at length depressed, somewhat zoned, moist, not viscid in wet weather: stem pallid white, sometimes dingy, stuffed to hollow, usually attenuated downwards, gills light wax-yellow colour, tan, tan-ochre, or shaded reddish salmon or straw colour, adnato-decurrent, thin, somewhat distant; flesh white; milk white, very acrid.

Woods and pastures. Common. Aug. to Dec. 5×3½×1. Suspicious.

**L. flexuosus** Fr. (1262). Can be distinguished from 1263 by the lead or violet-grey P., which becomes paler, rivuloso-scaly or floccose, with whitish velvety, incurved, margin, by the delicately pubescent S. with white apex and yellowish base, and the thick branched G. Woods. O. 5×3½×1. Suspicious.

**L. chrysorrheus** Fr. (1266).—P. pale yellowish *flesh-colour, with darker zones* or spots, convex, umbilicate, then infundibuliform: S. white, equal: G. pale yellowish, very thin, and crowded; milk and flesh white, then bright sulphur-yellow, very acrid. Oak woods. C. 3×2¼×½.

**L. acris** Fr. (1267).—P. cinereous fuliginous, somewhat spotted, convex, then plane, finally obliquely infundibuliform, irregular: S. pallid, apex white, attenuated downwards, often oblique; G. pallid, then *yellow flesh-colour, thin, forked*: milk and flesh white, then reddish, acrid; smell strong, stinking. Woods. R. 4×2×½. Suspicious.

**L. violascens** Fr. (1267 *a*).—P. grey or pale brown, with darker zones, convexo-expanded: S. greyish white, equal; G. white, then lilac, crowded; milk white, becoming violet, mild. Woods. R. 4×3×¾. Edible.

98. **L. piperatus** Fr. (1271). (Latin *piperatus*, peppery.)

Wholly white. Cap becoming yellowish with age, fleshy, rigid, umbilicate, then reflexed and infundibuliform, margin at first involute; stem solid, equal or obconical, subpruinose; gills becoming pale ochraceous, decurrent, crowded, narrow, dichotomous, edge obtuse; flesh white, then yellowish, sometimes becoming greenish grey; milk white, often becoming greenish when dry, very acrid.

Woods. Common. Aug. to Oct. 7×3×2. Edible.

**L. pergameus** Fr. (1270).—Differs from 1271 in the rugose wrinkled P., the longer, thinner S., and the adnate, horizontal G. Woods. O. 3×3×¾. Edible.

99. **L. vellereus** Fr. (1272). (Latin *vellus*, a fleece—from the pubescent cap.)

Wholly white. Cap becoming stained or spotted yellow, compact, convexo-umbilicate, then expanded and concavo-depressed, innato-pubescent, margin strongly incurved; stem becoming yellowish, equal, hard, finely pubescent; gills watery-white, then pale ochraceous, adnato-decurrent, arcuate, rather thick, subdistant, rather broad, branched, edge acute; flesh white, yellowish when broken; milk white, scanty, very acrid.

Woods. Common. Aug. to Dec. 8×6×2. Edible.

ii. Milk deeply coloured from the first.

**100. L. deliciosus** Fr. (1275). (Latin *deliciosus*, delicious.)

Cap orange brick-colour, becoming pale and verdigris-stained, concentrically zoned with darker markings, convex, then plano-depressed or broadly infundibuliform, slightly viscid, margin at first involute; stem concolorous or paler, usually spotted, often stained with verdigris, stuffed, then hollow, equal, or attenuated at the base, fragile; gills saffron-yellow, becoming greenish with age or when bruised, subdecurrent, crowded, narrow, arcuate, often branched; flesh white, soon stained orange when broken, then greenish; milk bright red-saffron, mild, then slightly acrid; smell pleasant, aromatic.

Coniferous woods. Common. July to Dec. $5 \times 2 \times 1$. Edible.

Not infrequently attacked by *Hypomyces lateritius* (No. 201): it should not then be eaten. *L. deliciosus* is represented in one of the frescoes excavated at Pompeii.

**L. sanguifluus** Fr. (1276).—Differs from 1275 in its smaller size, its reddish tawny P. spotted with darker markings, with margin at first involute and white pruinose, *in the pale ochraceous, then concolorous G., and the blood-red, slightly* acrid milk. Pine woods. O. $2\frac{1}{2} \times 2 \times \frac{3}{4}$. Edible.

iii. Gills pallid, then changing colour, afterwards darker, glancing when turned to the light, at length white pruinose; milk white at first and mild, sometimes becoming acrid.

*a.* Pileus at first viscid.

**L. pallidus** Fr. (1277).—P. flesh-colour or clay-colour to pallid, somewhat tan, convex to depressed, margin for a long time broadly involute; S. concolorous; G. whitish, then concolorous, rather broad, crowded, somewhat branched; milk white, acrid. Woods. C. $4 \times 2 \times 1$. Suspicious.

**L. quietus** Fr. (1278).—P. rich sienna flesh-colour, somewhat zoned, disc darker, very slightly viscid, then somewhat silky, opaque, becoming pale, margin deflexed at first; S. rufescent, then rubiginous, base hairy; G. white, soon brick-rufescent, somewhat forked at the base; milk white, sweet: smell oily. Woods. C. $4 \times 3 \times \frac{3}{4}$. Edible.

**L. aurantiacus** Fr. (1279).—Differs from 1278 in the bright golden orange P., the concolorous pruinose S., the yellowish flesh-coloured decurrent G., the slowly acrid milk, and the pleasant smell. Woods. F. $2\frac{1}{2} \times 2 \times \frac{1}{2}$. Edible.

**L. theiogalus** Fr. (1280).—P. liver-colour when moist, rufous tawny and lighter at the margin when dry, margin thin and crenulate; S. a little pinker than the P., attenuated at the base; G. pale rufescent, thin, subdistant; milk white, very slowly changing to sulphur-yellow, mild, then slightly acrid. Coniferous woods. F. $2\frac{3}{4} \times 2\frac{1}{4} \times \frac{3}{8}$. Edible.

**L. cremor** Fr. (1281).—P. tawny orange, convex to plano-depressed, often unequal and excentric, minutely punctate, margin striate; S. concolorous; G. white, then flesh-colour, subdistant, pruinose; milk whitish, often watery, mild or slowly acrid. Beech woods. R. $4 \times 1\frac{1}{2} \times \frac{1}{2}$. Edible.

**L. vietus** Fr. (1282).—P. flesh-colour or livid grey, becoming pale, subpapillate, at length subinfundibuliform, slightly silky when dry, margin somewhat deflexed; S. concolorous; G. whitish, then yellowish; milk and flesh white, then grey, slowly acrid; smell pungent. Woods. F. $3 \times 1\frac{1}{2} \times \frac{3}{8}$. Suspicious.

**L. cyathula** Fr. (1283).—P. rufescent brick or flesh colour, somewhat zoned, becoming pale, rimoso-rivulose, convexo-plane, then somewhat depressed, sometimes striate; S. paler than the P., then whitish, pruinose; milk white, acrid; flesh pinkish; odour of bugs when drying. Woods. R. $2 \times 2\frac{1}{4} \times \frac{1}{4}$. Edible.

*b.* Pileus squamulose, villous, or pruinose.

101. **L. rufus** Fr. (1284). (Latin *rufus*, red.)

Cap bay-brown rufous, soon depressed and finally infundibuliform, umbonate, dry, flocculoso-silky at first, then polished, margin involute when young and somewhat whitish tomentose; stem rufescent, paler than the cap, white pubescent at the base, stuffed, then hollow, slightly pruinose; gills ochraceous or pallid, then rufescent, adnato-decurrent, crowded; flesh pallid; milk white, very acrid.

Coniferous woods. Common. June to Dec. $4 \times 2\frac{1}{2} \times \frac{1}{2}$. Suspicious.

**L. glyciosmus** Fr. (1288).—P. yellowish, shaded over with pale lavender-purple, zoned pale purplish, convex to subdepressed, acutely papillate; S. light yellowish, tawny where bruised, pubescent; G. straw-colour to tawny flesh-colour; milk white, rarely greenish, mild, then slightly acrid; smell very pleasant, aromatic. Woods. C. $3 \times 2\frac{1}{2} \times \frac{3}{8}$. Edible.

102. **L. fuliginosus** Fr. (1289). (Latin *fuliginosus*, sooty.)

Cap tan-whitish, powdered with innate fuliginous pruina, coffee-*and-milk colour, finely velvety, then livid yellowish or fawn colour,* with the disc sometimes finally brown, rugulose, convex, then sub-repand and depressed, margin inflexed at first, then spreading; stem white, then dingy tan-colour, almost brick-red or fuliginous, stuffed, almost equal, even, or slightly rugulose; gills white, at length light yellow ochraceous, rounded adflexed, then decurrent, somewhat thin, subdistant, branched, connected by veins, the intermediate ones at length crisped; milk and flesh white, then rose-colour, at length saffron-yellow; taste mild, then slightly acrid.

Woods and pastures. Common. Aug. to November. $4\frac{1}{2} \times 3 \times 1$. Suspicious.

**L. lignyotus** Fr. (1291).—Can be distinguished from 1289 by the fuliginous umber, pruinosely velvety, plicato-rugulose, or wrinkled P. and the concolorous pruinosely velvety S., constricted and plicate at the apex and whitish at the base. Under firs and beeches. O. $3 \times 3 \times \frac{1}{2}$. Edible.

**L. picinus** Fr. (1290).—Differs from 1289 in the umber or blackish-umber, villose, somewhat velvety, then smooth P., the pruinose somewhat paler S., the ochraceous very crowded G., and the white acrid milk; flesh pallid, becoming reddish. Coniferous woods. O. $2\frac{1}{2} \times 2 \times \frac{3}{8}$. Suspicious.

*c.* Pileus smooth, polished.

103. **L. volemus** Fr. (1295). (Latin *volema pira*, the Red Warden pear.)

Cap rufous tawny, golden, becoming pale, compactly rigid, obtuse, plano-convex, at length depressed and rimoso-rivulose, margin paler, at first incurved; stem concolorous, stout, firm, solid, almost equal or attenuated upwards, pruinose; gills white to yellowish, adnato-decurrent, thin, crowded, becoming dingy when wounded; flesh white, becoming brownish when broken; milk white, sweet, plentiful; smell pleasant.

Woods. Aug. to Oct. F. $5 \times 4 \times \frac{1}{2}$. Edible.

**L. subdulcis** Fr. (1299).—P. rufescent, not becoming pale, convex to depressed, at first papillate; S. concolorous, equal, subpruinose; G. paler, crowded; milk white, somewhat mild; flesh rufescent. Woods. C. $3 \times 2 \times \frac{1}{2}$. Edible.

**L. serifluus** Fr. (1297).—Differs from 1299 in the brown, tawny, subflexuose P with inflexed margin, the concolorous solid S. with often strigose base, and the watery, insipid, scanty milk; smell unpleasant. Woods. C. $3 \times 2\frac{1}{4} \times \frac{1}{2}$. Edible.

**L. mitissimus** Fr. (1298).—Differs from 1299 in the golden-tawny P. and S. and the somewhat paler G., often minutely rufous-spotted, in the pallid flesh, and copious white, mild, then slightly bitter milk. Woods. C. $2 \times 2\frac{3}{4} \times \frac{3}{16}$. Edible.

**L. camphoratus** Fr. (1300).—Differs from 1299 in the brown brick-red somewhat zoned P., the concolorous S., the yellowish-brick G., reddish flesh, white mild watery milk, and the strong smell of Melilot when dried. Coniferous woods. C. $3 \times 2\frac{1}{4} \times \frac{1}{4}$. Edible.

**L. obnubilis** Fr. (1303).—Differs from 1299 in its brown fuliginous P., darker at the disc and striate at the margin, in the paler rugulose S. with concolorous hairs at the base, and the yellowish G.; flesh reddish; milk white, rather acrid. Woods. O. $2 \times 2 \times \frac{1}{4}$. Edible.

## XLVIII. RUSSULA Fr.

(Latin *russulus*, reddish—from the frequent reddish colour of the cap.)

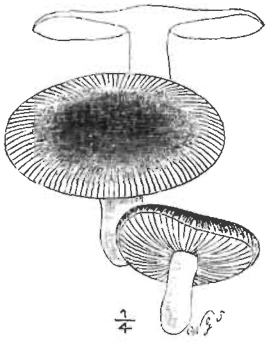

Fig. 53.—*Russula aurata* Fr. (× ¼.)

*Russula* is closely allied to *Lactarius*, but never exudes milk; the cap is fleshy and regular, and at length depressed; the stem is fleshy; the gills are more or less adnate, rigid, fragile, with acute edge and vesiculose trama; the spores are white or yellow, rarely greenish. Chiefly terrestrial. There are about sixty British species. No species having a mild taste is poisonous; it is probable that all species are edible after careful cooking.

Certain species are apparently concerned in the formation of mycorrhiza (see p. 9).

A differentiated pellicle is often present on the surface of the cap: this when composed of somewhat gelatinous hyphæ becomes viscid in wet weather; in other cases it remains dry and becomes pruinose or velvety.

i. Pileus fleshy, margin more or less involute; pellicle slightly developed, dry, adnate; gills unequal, alternate; flesh compact, firm.

104. **R. adusta** Fr. (1307). (Latin *adustus*, scorched—from its appearance.)

Cap pallid or whitish, becoming cinereous fuliginous, convex, then depressed and subinfundibuliform; stem concolorous, obese; gills white, then dingy, adnate to decurrent, thin, crowded, narrowed; flesh white, then brownish, finally blackish; taste mild.

Woods. Aug. to Nov. $3\frac{1}{2} \times 2\frac{1}{4} \times 1$. Edible.

*Nyctalis parasitica* (p. 111) is common upon this species.

**R. nigricans** Fr. (1306).—P. olivaceous fuliginous, then black, convex to umbilicato-depressed; S. pallid, then black; G. ochraceous, thick, distant, wide, reddish when bruised; flesh white, becoming red when broken and finally black; taste mild, then acrid. Woods. C. $5\frac{1}{2} \times 2\frac{1}{2} \times 2$. Edible.

*Nyctalis asterophora* (p. 111) is common upon this species.

**R. albonigra** Fr. (1308).—Differs from 1307 in the white P. becoming fuliginous near the margin, in the fuscous S., and in the flesh becoming immediately black when broken. Woods. O. $3\frac{1}{2} \times 2 \times 1\frac{1}{2}$. Edible.

**R. delica** Fr. (1311).—P. white, becoming spotted light brown, convex to depressed, at first delicately tomentose; S. white, then shaded brownish, attenuated at the base; G. white, exuding watery drops when young, crowded, narrow; flesh white; smell pleasant; taste slowly acrid. Woods. F. 5×2×1½. Edible.

**R. chloroides** Bres. (1311 *a*).—*Differs from 1311 in the pallid, then ochraceous P., areolately cracked in dry weather, in the white, then concolorous rugulose S. with green zone at the apex, and in the greenish G., which become pallid and often fuscous-spotted when old, connected by veins; flesh white, cheesy; taste acrid. Woods. C. 4×2½×1.

**R. mustellina** Fr. (1313).—P. bright brown or dingy yellowish, convex to depressed, margin incurved at first and minutely tomentose; S. white, somewhat rugose; G. white, then cream, connected by veins; taste pleasant. Woods. 3×2×¾. Edible.

ii. Pileus compact, firm, margin abruptly thin, at first inflexed, acute, even, pellicle adnate, finally disappearing; stem compact, then internally spongy-soft; gills somewhat forked.

105. **R. sanguinea** Fr. (1316). (Latin *sanguineus*, bloody.)

Cap blood-red or becoming pale round the spreading acute margin, fleshy, firm, convex, obtuse, then depressed and infundibuliform, disc generally gibbous, polished, moist in damp weather; stem reddish, rarely white, at first contracted at the apex, then equal, firm, wrinkled, striate, pruinose; gills white, then cream, decurrent, rarely forked, crowded, narrow, connected by veins; flesh white, reddish under the cuticle, cheesy; taste acrid.

Woods, especially coniferous. Aug. to Sept. O. 4×2¼×1. Suspicious.

**R. rosacea** Fr. (1317).—Differs from 1316 in the rose to whitish, viscid, irregular, often excentric, repand, scarcely depressed P., variegated with darker spots when dry, in the white to reddish smooth S., and the white, adnate, forked G. with uneven edge, which is often reddish near the margin of the P. Woods. F. 3½×2×1. Suspicious.

**R. olivascens** Fr. (1314).—P. olivaceous, becoming yellowish at the disc, convex, then expanded and umbilicate; S. white; G. cream-colour, then yellowish, adnexed; flesh white; taste mild, then slightly acrid. Woods. O. 5×2×1. Edible.

**R. furcata** Fr. (1315).—P. green, becoming somewhat ochraceous at the disc, gibbous to depressed, polished in dry weather, margin thin; S. white; G. white, sometimes spotted brown when old, adnato-decurrent, forked at the base, sub-distant, rather thick; flesh brownish under the separable pellicle; taste mild. Woods etc. C. 5½×3×1. Suspicious.

**R. maculata** Quél. (1318).—P. reddish flesh-colour, becoming yellow or ivory-white spotted purple or brown, convex to plane, viscid, margin undulate and generally remaining red; S. white, sometimes tinged rose, finally spotted red or bistre, polished reticulato-striate; G. pale sulphur, then peach-colour, attenuato-adnate, forked; taste mild, then acrid; smell of apple. Woods. O. 3×1½×¾. Edible.

**R. drimeia** Cooke (1323) (*R. expallens* Gill., 1346).—P. bright purple to dark rose, decolouring with age, subviscid when moist, opaque when dry, margin incurved, substriate when old; S. tinged purple, sometimes mealy; G. pale sulphur to deeper yellow, adnexed, narrow, furcate at the base; flesh reddish under cuticle of the P. and S.; intensely acrid. Coniferous woods. C. 4×3×¾. Doubtful.

**R. Queletii** Fr. (1345).—Differs from 1323 in the white to biscuit G., which exude drops that on drying leave azure-blue, cinereous, or pallid olivaceous spots. Coniferous woods. C. 3×2½×½. Doubtful.

iii. Pileus without a viscid pellicle, cuticle breaking up into flocci or granules; stem solid. at first hard; gills, a few dimidiate, others divided, running out with a broad rounded front: flesh thick, firm, ending short of the margin of the pileus.

**R. rubra** Cooke (1329) (*R. atropurpurea* Maire). (Latin *ruber*, red.)

Cap deep blood-red, almost black at the disc, often yellowish at the margin when young, hemispherical, then convexo-plane, finally depressed or infundibuliform, fleshy, firm, viscid, slightly rugulosely wrinkled, margin thin, substriate when old, often exceeding the gills; stem white, sometimes slightly stained ochraceous brown, sometimes rosy in the middle, base ochraceous, firm, somewhat equal, slightly rugoso-striate, apex pruinose; gills white, then yellowish, sinuato-free, attenuated behind, broader in front, equal, rather crowded; flesh whitish, reddish purple under the cuticle, sometimes becoming slightly stained ochraceous brown; taste mild or acrid; smell slight, pleasant.

Woods and under conifers. Common. Aug. to Oct. 3½×3×1.

**R. depallens** Fr. (1320).—Differs from 1329 in the P. soon losing its colour and in the S. and flesh becoming grey with age. Woods. C. 3½×2×¾. Edible.

**R. lactea** Fr. (1325).—P. milk-white, then tan-white, often excentric, pruinose, then minutely cracked; S. white, pruinose; G. whitish cream-colour, free, very broad, thick, distant, forked; taste mild. Woods. O. 3×2×¾. Edible.

**R. virescens** Fr. (1326).—P. deep or pallid green, pulvinate to depressed, often unequal, flocculose cuticle soon broken up into patches or warts: S. white or whitish cream, pruinose, subrivulose: G. white, then whitish cream, thick, somewhat crowded, forked: taste mild. Woods. C. 4×3×1. Edible.

**R. lepida** Fr. (1328).—Differs from 1326 in the deep red-rose, convex, then expanded P., which becomes pale with the disc tan-colour, pruinose, then often rimoso-squamulose, in the white S. often tinged rose, and the whitish-cream G. often having a denticulate red edge, connected by veins; taste pleasant, then slowly acrid. C. 4×2×1. Edible.

**R. Linnæi** Fr. (1330).—P. dark purple, blood-red, or bright rose, opaque, convex to plano-depressed, dry, pruinose; S. blood-red to pale rose, subventricose, spongy within, obsoletely fibrilloso-reticulate; G. white, then ochraceous, adnato-decurrent, rather thick; taste mild. Woods. R. 5×4×1¼. Edible.

**R. xerampelina** Fr. (1331).—P. rosy purple, disc becoming yellowish white, convex to depressed, without a distinct pellicle, subviscid at first, then finely granulate; S. white or reddish; G. whitish to yellowish, adnexed, somewhat crowded; flesh white, brownish when old; taste mild; smell strong of crab. Woods. F. 4½×3½×1. Edible.

**R. olivacea** Fr. (1332).—P. dingy purple to olivaceous or fuscous-olivaceous, convex, then plano-depressed, slightly silky or squamulose: S. rose-colour or pallid, ventricose; G. bright yellow, adnexed, wide, with shorter and forked ones intermixed, crowded; flesh white to yellowish; taste mild. Coniferous woods. O. 4×3×1. Edible.

**R. serotina** Quél. (1333).—P. violet, lilac, bistre, or olivaceous, margin lilac with the extreme edge white, globose, then plane, white pruinose when young; S. white, minutely pubescent, wrinkled; G. white, then tinged yellowish, adnate, crowded. Beech woods. O. 1¼×1×$\frac{3}{16}$. Edible.

iv. Pilcus fleshy, firm, with the margin thin and at first inflexed, then expanded and striate, covered with a thin adnate pellicle: stem solid, stout, spongy within; gills, many shorter mixed with longer ones, others furcate.

**R. heterophylla** Fr. (1339). (Greek *heteros*, different, *phullon*, a leaf.)

Cap greenish or yellowish brown, disc becoming ochraceous, very variable in colour, but never reddish nor purple, fleshy, firm, convex, then plane and depressed, margin thin and sometimes densely substriate; stem shining white, equal, or attenuated at the base, firm, delicately striate; gills shining white, decurrent, very narrow, *very crowded, thin, often forked; flesh white; smell and taste* pleasant.

Woods. Uncommon. July to Oct. 4×2×1. Edible.

**R. cyanoxantha** Fr. (1338).—P. lilac or purplish, then olivaceous green, disc usually becoming pale or yellowish and the margin azure-blue or livid purple, hemispherical to depressed, viscid, sometimes wrinkled or striate; S. white, rarely tinged lilac, elastic; G. white, connected by veins, broad; flesh purplish or reddish under the pellicle: taste pleasant. Woods. C. 4×3×¾. Edible.

**R. lilacea** Quél. (1336).—Differs from 1338 in the violet-lilac or brownish, thin P. with striate margin becoming whitish, in the white, corticate, wrinkled striate S. often rosy at the base, with pruinose apex; smell of apple. Woods. O. 3½×2¼×¼. Edible.

**R. azurea** Bres. (1337).—Differs from 1338 in the bright blue, minutely granular P. which becomes pale, margin sometimes lilac and finally substriate; S. rugulose; flesh wholly white. Coniferous woods. O. 4×2×¾. Edible.

**R. consobrina** Fr. (1340).—P. dark cinereous or fuscous olivaceous, fragile, campanulate, then expando-depressed, margin membranous; S. white, at length cinereous; G. white, then greyish, free, forked, broad, crowded, thick; flesh cinereous under the pellicle; taste very acrid; smell faint. Coniferous woods. F. 3½×1½×½. Suspicious.

106. **R. fœtens** Fr. (1341). (Latin *fœtens*, stinking.)

Cap dingy yellow, often becoming pale, fleshy, but thin, globose, then expanded and depressed, rigid, viscid in wet weather, margin broadly membranaceous, at first incurved and finally tuberculately striate; stem whitish, ventricose; gills whitish or straw-colour, often dingy when bruised, exuding watery drops when young, adnexed, crowded, connected by veins, often forked; flesh white, then ochraceous; taste acrid; smell very strong.

Woods. Common. July to Nov. 4×3×1. Suspicious.

**R. subfœtens** W. G. Sm. (1342).—Differs from 1341 in the somewhat lighter coloured, convex to plane, and subdepressed P., which is paler at the striato-tuberculate margin, and in the thick, distant, yellowish-white G., which do not exude drops. Grassy places. F. 3×2×¾. Suspicious.

**R. fellea** Fr. (1343).—Wholly straw-colour. P. often darker tinged, especially at the disc, margin striate when old; G. exuding watery drops, then spotted yellow, adnate, crowded, thin; flesh whitish, then concolorous; taste very acrid and bitter. Beech woods. C. 4×2½×¾. Suspicious.

v. Pileus more or less fleshy, covered with a continuous pellicle, which is viscid and somewhat separable in wet weather; margin membranous and at first convergent, then commonly sulcate and tubercular; stem spongy, then wholly soft and hollow; gills almost all equal, simple, broadening in front, free.

*a.* Gills and spores white.

107. **R. emetica** F. (1347). (Greek *emetikos*, provoking sickness.)

Cap rosy, then blood-colour, tawny when old, sometimes becoming yellow and finally white, campanulate, then flattened or depressed, polished, sometimes rugulose, margin at length tubercularly sulcate; stem white or reddish, rigid; gills shining white, free or adnate, broad, subdistant; flesh white, reddish under the separable pellicle; taste very acrid.

Beech woods and under beeches. Common. July to Dec. $4 \times 3 \times 1$. Poisonous.

**R. fragilis** Fr. (1354).—Differs from 1347 in its smaller size, in the paler coloured and thinner P., in the very fragile, pruinose, often slightly striate S., in the very thin, crowded, ventricose G., and in the flesh not becoming red under the pellicle. Woods etc. C. $2\frac{3}{4} \times 2 \times \frac{3}{4}$. Poisonons.

**R. pectinata** Fr. (1349).—P. toast-brown, becoming pale tan, disc darker, margin thin and tuberculoso-sulcate; S. white, rigid, substriate; G. whitish, subcrowded; flesh light yellowish under the pellicle; taste very acrid; smell unpleasant. Woods etc. F. $3 \times 1\frac{3}{4} \times \frac{3}{4}$. Suspicious.

**R. ochroleuca** Fr. (1350). P. yellow, becoming pale, polished; S. cinereous, slightly reticulately rugose; G. white, then pallid, free, fragile; flesh yellowish under the pellicle; taste acrid; smell pleasant. Woods. C. $3\frac{1}{2} \times 2 \times \frac{3}{4}$. Edible.

**R. citrina** Gill. (1353). Differs from 1350 in the bright citron-yellow P., occasionally paler at the margin, sometimes finally greenish, with disc becoming pale ochraceous, margin thin, tuberculosely striate with age, in the white striate S., and the white subdecurrent G. forked at the base; taste mild, becoming acrid. Woods etc. O. $3 \times 2 \times \frac{3}{4}$. Edible.

**R. æruginea** *Fr.* (1355).—P. æruginous green, disc slightly brownish bistre, margin paler and striate; S. white, rugose; G. white, then cream, sometimes spotted brown, often connate in pairs at the base. Woods. F. $5 \times 2 \times 1$. Edible.

**R. punctata** Gill. (1352). P. rose, purple, purple-violaceous, lilac, often tinged yellowish or greenish, granularly mealy, often punctate with deeper-coloured granules; S. concolorous or white, pruinosely mealy; G. whitish cream, then cream, edge often purple and floccose, adnate, thin, crowded; taste mild. Coniferous woods. O. $2\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4}$. Edible.

*b.* *Gills and spores white, then lemon-yellow.*

108. **R. integra** Fr. (1357) (*R. Romellii* Maire). (Latin *integer*, entire.)

Cap reddish, purple, violet, becoming olivaceous, isabelline, or whitish, convex, then plane and more or less depressed, soft, fragile, viscid, disc often streaked with innate fibrils, margin rounded, often striate, rarely tuberculoso-striate; stem white, pruinose, becoming glabrous, subcylindrical, wrinkled-striate, sometimes distinctly corticate; gills white, at length yellow, somewhat ochraceous pulverulent with the spores, free or subadnate, very broad, equal, subdistant, rarely forked or unequal, more or less connected by veins; flesh white, rarely a little violaceous under the cuticle; smell weak, taste pleasant.

Deciduous woods. Common. June to Nov. $5 \times 2\frac{1}{2} \times 1\frac{1}{4}$. Edible.

**R. alutacea** Fr. (1362).—Differs from 1357 in the thin, then tuberculosely striate margin of the P., in the smooth white S. being generally reddish at the

apex or on one side and sometimes *yellowish at the base, and in the thick pale* light yellow G. soon becoming ochraceous egg-yellow, not pulverulent with the spores. Beech woods. C. 5×3×1. Edible.

**R. veternosa** Fr. (1356).—P. rose or flesh colour, soon becoming pale, commonly whitish or yellowish at the disc, hemispherical to subdepressed, viscid pellicle adnate; S. white, often pinkish towards the base, fragile, equal; G. white, then bright yellow; taste acrid. 3×2½×½. Suspicious.

**R. decolorans** Fr. (1358). P. orange-red, becoming light yellow, then pale, spherical, then expanded and depressed, margin thin and finally striate; S. white, then cinereous, often rugoso-striate; G. white, then yellowish, thin, rounded, free, crowded; flesh white, then cinereous; taste mild, then slightly acrid. Coniferous woods. O. 3½×4×¾. Edible.

**R. aurata** Fr. (1359).—P. lemon-yellow, orange, or red with darker disc, convex, then plane, rigid, margin thin, slightly striate when old; S. white, tinged lemon-yellow, with bright lemon edge, rounded, free, connected by veins; flesh white, lemon-yellow under the separable pellicle; smell pleasant; taste mild or slowly acrid. Woods. F. 3×2×¾. Edible.

**R. nitida** Fr. (1361).—P. bay-brown purplish, disc darker, shining when dry, margin thin and somewhat tuberculate; S. white, rigid, minutely wrinkled, pruinose; G. pallid, then bright sulphur-yellow, thin, crowded; taste mild, then acrid; smell sometimes unpleasant. Woods. F. 1×1½×½. Edible.

*c.* Gills and spores ochraceous.

**R. nauseosa** Fr. (1367). Differs from 1361 in its P. being variable in colour, typically purplish at the disc, then livid, and finally pale or whitish, with the submembranous margin tuberculoso-sulcate, in the white substriate S. becoming grey, and in the light yellow, then dingy *ochraceous, subdistant* G.; smell often unpleasant. Coniferous woods. O. 2×2×½.

**R. puellaris** Fr. (1364).—Differs from 1361 in the livid purplish, then yellowish P., with brown disc and tuberculosely striate margin, in the white rugulose S. becoming yellowish, brownish where bruised, and in the G. being white, then pale yellow. Woods and damp places. C. 2×2½×¼.

**R. chamæleontina** Fr. (1369). P. flesh-colour, rosy blood-red, or purplish lilac, becoming yellow at the disc, then wholly yellow, viscid pellicle separable, margin substriate when old; S. white, pruinose, substriate; G. light yellow, then darker, thin, crowded; taste mild. Woods etc. O. 1½×1¼×¼. Edible.

**R. lutea** Fr. (1366). P. yellow, finally pale or white, convex to plano-depressed, thin, viscid, margin sometimes substriate when old; S. white; G. ochraceous egg-yellow, connected by veins, crowded; flesh white; smell pleasant of apricot; taste mild. Woods and lawns. C. 3×2×⅜. Edible.

**R. armeniaca** Cooke (1363).—Differs from 1366 in the rich apricot-colour of the P. Woods and lawns. C. 2¼×2¼×½. Edible.

**R. vitellina** Fr. (1368).—Differs from 1266 in the egg-yellow P., with tuberculately striate margin, the concolorous S., the distant saffron-yellow G., and the strong unpleasant smell. Coniferous woods. O. 1¾×1×½. Edible.

**R. ochracea** Fr. (1365).—Differs from 1366 in being wholly ochraceous. P. with thin sulcate margin; S. striate, rarely white; G. broad, *scarcely crowded*; flesh ochraceous. Woods. O. 3¼×2×¾. Edible.

## XLIX. CANTHARELLUS Juss.

(Greek *kantharos*, a cup.)

In *Cantharellus* the gills are decurrent, thick, fleshy-waxy, fold-like, somewhat branched, with obtuse edge and floccose trama; the cap is fleshy or membranous, regular, excentric, or lobed; the stem central, excentric, or obsolete; the spores are white. The species grow on the ground and on mosses, rarely on wood. There are about

i. Pileus and solid stem fleshy.

109. **C. cibarius** Fr. (1370). (Latin *cibarius*, pertaining to food.) Chantarelle.

Fig. 54.—*Cantharellus cibarius* Fr. (× 1/3.)

Entirely egg-yellow. Cap convex, turbinate, then plane or slightly depressed, at length repand with lobed margin; stem solid, attenuate downwards; gills very shallow, thick, distant, branched; odour pleasant, of apricots or ripe greengages, sometimes a little earthy or heavy.

Woods. Common. July to Dec. 4×2×1. Edible.

"The flesh of *C. cibarius* is somewhat firm, so that it is necessary in cooking to slice or mince and allow to simmer with meat over a slow fire for fifteen or twenty minutes: or put in boiling water to soften the flesh, and then slowly stew in butter with pepper and salt and serve with eggs and bread-crumbs."—W. G. S.

**C. Friesii** Quél. (1371). Differs from 1370 in being smaller, in the orange, then ochraceous, villose P., in the yellow pruinose S., with white villose base, in the yellow flesh-colour or orange G., and in the somewhat sour taste. Beech woods. O. 1½×1×1/6. Edible.

110. **C. aurantiacus** Fr. (1372) (*Clitocybe*). (Latin *aurantiacus*, orange-yellow.)

Cap orange-ochraceous, fleshy, soft, often excentric, depressed, undulate, tomentose, margin involute; stem ochraceous or reddish sienna, or blackish at the base, stuffed to hollow, attenuate downwards; gills deep orange or orange-vermilion, decurrent, thin, crowded, repeatedly branched; flesh yellowish; taste unpleasant.

Woods, heaths, and pastures. Common. June to Dec. 3×2×¼. Extremely variable; the whole plant may be cream in colour when growing amongst grass.

*Dactylium dendroides* (*Hypomyces rosellus*) (see p. 194) is common on the gills.

**C. carbonarius** Fr. (1374).—P. date-brown, then black, umbilicate or infundibuliform, coriaceous, minutely squamulose, margin lobed: S. paler than the P., rooting, striate, sometimes branched; G. white, then glaucous or grey, decurrent, narrow. Charcoal heaps and burnt ground. C. 2½×1×½: rooting S. 2½.

**C. umbonatus** Pers. (1375).—P. cinereous blackish, floccoso-silky, margin incurved and white, convex and umbonate to depressed; S. concolorous, base white-floccose: G. white, often red when bruised, thin, crowded, repeatedly branched. Woods etc. O. 1¼×3×1/6. Edible.

**C. albidus** Fr. (1376).—Wholly whitish to faintly yellowish. P. sometimes rufescent, convex, umbilicate, thin, lobed, subvillose: S. tough, flexuose; G. crowded, repeatedly dichotomous. Woods etc. O. 2×1×¼. Edible.

ii. Pileus submembranous; stem tubular, shining.

**C. infundibuliformis** Fr. (1380). P. yellowish cinereous or fuliginous, paler when dry, umbilicate, then infundibuliform, sometimes pervious to the base of the stem, floccoso-wrinkled: S. light yellow, base somewhat thickened; G. light yellow, then pruinose and grey, anastomosing. Woods. C. 2×2½×¾. Edible.

**C. tubæformis** Fr. (1379).—Differs from 1380 in its fuscous P. and in the compressed orange-tawny, lacunose S. Woods. C. $5 \times 4 \times \frac{3}{4}$.

**C. cinereus** Pers. (1381).—P. hoary fuliginous, becoming whitish, often pervious to the base of the stem, villoso-squamulose; S. concolorous, then blackish, fibrillosely striate, attenuated downwards, curved: G. cinereous, then whitish, pruinose, distant, connected by veins; flesh blackish; smell pleasant. Woods. O. $2 \times 2 \times \frac{3}{8}$. Edible.

## L. NYCTALIS Fr.

(Greek *nux*, night—from growing in dark places.)

*Nyctalis* is characterised by growing on other Agarics; the cap is fleshy; the gills adnate, fleshy, thick, soft, obtuse at the edge, distant; the spores are white. Reproduction is also effected by conidia borne on the cap. There are two British species.

**N. asterophora** Fr. (1389).—P. white, then fawn-colour from the large stellate chlamydospores, conical, then hemispherical, flocoso-pulverulent; S. white, then fuscous, solid, equal, pruinose: G. white, then dingy, very shallow, somewhat forked, often wanting. On *Russula nigricans* etc. C. $\frac{3}{4} \times \frac{3}{4} \times \frac{3}{16}$.

The stellate chlamydospores on the cap were at one time regarded as belonging to the parasitic fungus *Hypomyces asterophorus* (p. 194). However, it has been clearly demonstrated that they really belong to the *Nyctalis*: when sown on appropriate nutrient media they give rise to the basidial form. The chlamydospores are binucleate.

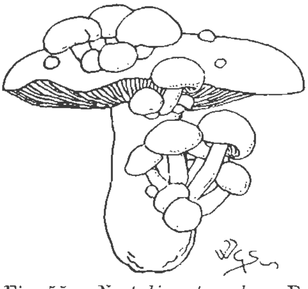

Fig. 55. *Nyctalis asterophora* Fr., growing on *Russula adusta* Fr. (× ½.)

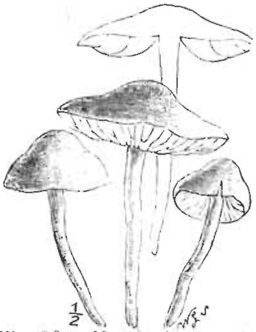

Fig. 56.—*Marasmius oreades* Fr. (× ½.)

**N. parasitica** Fr. (1390).—P. whitish fuscous, becoming pale whitish, conico-campanulate to expanded, obtuse or umbonate, pellicle persistent, pruinose, grey: S. white, fistulose, pubescent, base hairy: G. white, then fuscous, finally contorted and anastomosing. On *Russula fœtens*, *R. adusta*, *Lactarius vellereus*, etc. C. $1 \times 2 \times \frac{1}{8}$.

Smooth chlamydospores are produced on the gills, totally replacing basidiospore formation.

## LI. MARASMIUS Fr.

(Greek *maraino*, to wither or shrivel—from the species drying or shrivelling and not becoming putrescent.)

*Marasmius* closely resembles *Collybia*, but shrivels in dry weather and revives with moisture; the odour of meal, so common in the

latter genus, is absent from *Marasmius*, but is sometimes replaced by one of garlic or onions; several species are highly fœtid. The cap is arid, pliant, and somewhat thin; the stem cartilaginous or horny; the gills are usually simple, pliant, subdistant, with acute entire edge; the spores are white. The species are usually small, thin, and epiphytic; those which appear to grow on the ground are generally on putrid leaves or roots of grasses. There are about fifty British species; some are edible, more are esteemed for flavouring.

i. *Pileus with a thin, unspecialised, cellular pellicle.*

**M. urens** Fr. (1391). (Latin *urens*, burning.)

Cap pale yellowish or brownish, middle darker, convex to expanded, even or slightly squamulose, rimoso-rivulose when dry; stem white or yellowish, wholly white floccose, equal or slightly bulbous at the base; gills pale yellowish brown to brownish, free to remote; flesh yellowish; taste very acrid.

Woods. Uncommon. May to Oct. $4\frac{1}{2} \times 5 \times \frac{1}{4}$. Suspicious.

111. **M. porreus** Fr. (1393). (Latin *porrum*, a leek.)

Cap opaque dull yellow, paler when dry, thin but leathery, flaccid, convex, then flattened, obtuse, even on the disc, striate at the margin; stem red-brown, paler at the apex, stuffed, then hollow, tough, pubescent, somewhat thickened at both ends, containing a red juice; gills light yellowish, becoming paler, free, distant, broadly linear, somewhat thick, tough, at length leathery; flesh reddish; smell strong of garlic.

Woods. Uncommon. Sept. to Dec. $2\frac{1}{4} \times 4 \times \frac{1}{8}$.

Dried examples of this species in the Department of Botany, over one hundred years old, retain their garlic odour.

**M. peronatus** Fr. (1392). Differs from 1393 in its light yellowish or pallid brick rufescent, flaccid, slightly wrinkled, at length lacunose P., in its white S., clothed below with dense white or yellowish strigose down, in its cream, then yellowish and rufescent crowded G., and its yellowish flesh. Woods. C. $3\frac{1}{2} \times 4 \times \frac{3}{16}$.

112. **M. oreades** Fr. (1394). (Greek *oreias*, a mountain nymph.) Fairy-ring Champignon.

Cap at first livid-buff, with a darker disc, becoming paler when dry, hygrophanous, convex, then plane, somewhat umbonate, even, smooth, slightly striate at the margin when moist; stem pallid, solid, very tough, stiff, and straight, covered with a fine, interwoven, dense villosity; gills pallid-whitish, free, very broad, distant, the intermediate ones shorter, at first soft, then firmer; odour somewhat fragrant, stronger when dried.

Pastures, lawns, downs, roadsides. Common. May to Oct. $2\frac{1}{2} \times 2\frac{3}{4} \times \frac{1}{8}$. Edible.

The tough stems should be discarded in cooking. The fungus is best for the table when slowly stewed with butter. When carefully cooked the flavour is delicious, and revived dried examples are almost equal to fresh ones. It may be pickled or dried for winter use; a colourless ketchup can be made from it.

*Marasmius oreades* was the first fungus recorded as forming fairy rings (see p. 6), and many investigators have studied their formation in this species.

Three zones are very apparent in the rings, an outer and an inner dark green grass zone, separated by a zone of dead grass. The outer zone is only about an inch in width at first, but as the summer advances it extends until it is broader than either of the others. During late summer and autumn, the dead grass of the middle zone is gradually replaced by dark green grass, similar to that of the other zones; this apparent revival is due to invasion by the rhizomes of neighbouring grasses. The soil under the three zones is well penetrated with mycelium to a depth of about a foot. During winter the mycelium in the outer zone increases until it can be seen round the grass-shoots at the surface almost like cotton wool. About February or March the grass of this zone begins to flag, and finally dies, and what was the outer dark green grass of one year becomes the dead grass ring of the year following. According to Bayliss, the fungus is parasitic on the grass. The fungus mycelium secretes enzymes which cause stimulation when it first attacks the grass-plants, since by means of them it breaks up organic compounds of the soil which would otherwise be unavailable for the grass; some of these the fungus will assimilate, while others are absorbed by the grass-roots. The fungus first excretes a toxic substance which kills the sensitive root-tips and root-hairs, then penetrates the root-apex, then the cortical tissue of the root, and finally destroys the whole plant, except the stele. The outer darker zone would therefore be accounted for by the small amount of mycelium at the circumference, so that its destructive influence is more than compensated for by the entire supply of food-material it renders available for the grass-plant; the middle zone by the more copious mycelium killing off the grass; and the inner stimulated zone by the manuring of the soil by the dying off of the fungus and the presence of the dead plant-remains.

**M. prasiosmus** Fr. (1397).– P. pale dingy yellow or whitish, disc darker, submembranous, campanulate to flat, obtuse, rugulose; S. pallid, becoming reddish below, tough, tomentose, thickened and often incurved at the base; G. white, then pallid, somewhat crowded; taste and smell strong of garlic. Beech woods. O. $1 \times 2\frac{1}{4} \times \frac{1}{8}$. Edible.

**M. Wynnei** B. & Br. (1401) (*M. globularis* Fr.).– P. milk-white, often tinted with rose or greyish-violet, becoming brownish-violaceous, globose, then campanulate, hygrophanus, pellucidly striate; S. white, then brownish at the base, flexuose, pulverulent; G. white, then dingy; smell pleasant; taste mild. Beech woods. F. $2 \times 3\frac{1}{2} \times \frac{3}{16}$. Edible.

**M. erythropus** Fr. (1402).— P. pallid, becoming whitish and slightly wrinkled when dry, hygrophanous, slightly fleshy, convex, then plane, obtuse, striate; S. dark red, apex paler, tough, shining, pruinose when dry, base white strigose; G. whitish to pale salmon, broad, lax, veined, subdistant; taste mild. Woods etc. C. $2 \times 4 \times \frac{1}{8}$. Edible.

**M. scorodonius** Fr. (1406).—P. rufous, soon becoming pale to whitish, membranous, pliant, convex, soon plane, finally wrinkled and crisped; S. rufous, shining, horny, tough, inserted and wrinkled at the base; G. whitish, connected by veins, crowded; odour strong of garlic. Twigs etc. R. $1\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{16}$. Edible.

ii. Pileus with a thick cellular pellicle; cells upright, echinulate or verrucose (*Androsaceus*).

**M. ramealis** Fr. (1413). P. white, somewhat fleshy, convex, then plane, slightly wrinkled; S. whitish, rufescent at the base, sometimes with a small tubercle, mealy; G. white, connected behind, subdistant, narrow. Densely gregarious on twigs etc. C. $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{16}$.

113. **M. rotula** Fr. (1418). (Latin *rotula*, a small wheel—from the appearance of the gills.)

Cap whitish, or with a small brownish umbilicus, membranous, dry, convex, plicate at the margin; stem deep brown or blackish, shining,

horny, hollow, striate when dry; gills white, few, distant, attached to a collar which encircles, but does not touch the stem.

Growing gregariously on dead twigs. Common. May to Jan. $\frac{1}{2} \times 2 \times \frac{1}{64}$.

**M. calopus** Fr. (1407).- P. whitish, convexo-plane, obtuse, fleshy, membranaceous, slightly wrinkled when dry: S. deep rich brown, tough, shining, attenuated upwards; G. white, thin, subdistant. On twigs etc. C. $\frac{3}{4} \times 1 \times \frac{1}{32}$.

**M. androsaceus** Fr. (1420).—P. whitish or subfuscous, membranaceous, wrinkled striate: S. black, horny, very tough, contorted and striate when dry: G. whitish to salmon, crowded. Leaves etc. C. $\frac{1}{2} \times 2 \times \frac{1}{64}$.

Sometimes growing from masses of black horse-hair like mycelium

**M. Hudsonii** Fr. (1425).- P. and S. beset with erect purple hairs. P. pale fuscous rufescent, hemispherical, wrinkled: S. dark purple or reddish brown, horny, apex pale; G. white, distant, the alternate ones dimidiate. On holly leaves. F. $\frac{1}{4} \times 2 \times \frac{1}{64}$.

## LII. LENTINUS Fr.

(Latin *lentus*, tough or pliant.)

The cap is fleshy coriaceous, pliant or hard, persistent: the stem is hard, central, excentric, lateral or absent; the gills are adnate or decurrent, thin, membranous, tough, with the edge acute and usually serrate or irregular. The species are solitary or cæspitose, usually growing on wood. There are about twelve British species.

*Lentinus* is distinguished from *Pleurotus* by the hard flesh and serrate gills. Many tropical species grow from large sclerotia.

Fig. 57.—*Lentinus cochleatus* Fr. ($\times \frac{1}{4}$.)

114. **L. tigrinus** Fr. (1432). (Latin *tigrinus*, spotted like a tiger.)

Cap white or pale yellowish, variegated with blackish hairy squamules, middle sepia, fleshy-leathery, thin, convexo-plane, umbilicate when dry: stem creamy-white, fuscous at the base, squamulose, thin, solid, hard, central to excentric, furnished at the apex with an entire, reflexed, fugacious ring; gills white, then yellowish, decurrent, narrow, serrate, crowded, unequal; odour strong, acrid.

On stumps, branches, railway sleepers, etc. Frequent. April to Oct. $3 \times 1 \times \frac{1}{4}$.

When young the odour is agreeable and the fungus is tender enough to be eaten.

**L. lepideus** Fr. (1433).—P. pallid ochraceous, commonly excentric, convex, then plane or depressed, sometimes cracked, clad with darker adpressed scales, fleshy, very compact, irregular; S. whitish, covered with tomentose scales which become rufescent, apex smooth, base woody, sometimes rooting, at first cortinate towards the apex: G. whitish or yellowish, sinuate, decurrent by a tooth, broad, transversely striate: odour strong, pleasant. Pine stumps etc. F. $5\frac{1}{2} \times 5 \times 1$.

A common destructive agent on railway sleepers and other wooden structures. When the fungus develops in the dark, no cap is formed and the stipe or stipes are thin, *Clavaria*-like, often branched, and reaching up to a foot or more in length. Buller has shown that when a young papilla of the fungus develops in the dark, it

is perfectly indifferent to geotropic stimuli. In weak light it is positively heliotropic: when the tip of the stipe is acted on with sufficient intensity, it flattens and extends in a symmetrical manner to form a pileus. After pileus development is initiated, the stipe becomes strongly negatively geotropic and loses its power of reacting towards light.

**L. cochleatus** Fr. (1437).—P. flesh-colour, becoming brownish-isabelline, fleshy-pliant, thin, commonly excentric, imbricated, very unequal, somewhat lobed or contorted, plane or infundibuliform, umbilicate; S. flesh-colour, rufous-fuscous below, sometimes central, sometimes wholly lateral, sulcate, usually connate at the base; G. flesh-colour, crowded; smell strong of anise; taste mild. Stumps. C. $2\frac{1}{2} \times 5 \times \frac{1}{4}$. Edible.

## LIII. PANUS Fr.

(Latin *panus*, a tumour—a name used by Pliny for an arboreal fungus.)

Fig. 58.—*Panus torulosus* Fr. ($\times \frac{1}{4}$.)

*Panus* is closely allied to *Lentinus*, but differs principally in the gills being somewhat soft at first and not having the edge serrate. Growing on wood. There are about six British species.

**P. torulosus** Fr. (1443). P. somewhat flesh-colour, varying rufescent livid and becoming violet, very excentric, plano-infundibuliform; S. pale, covered with grey, often violaceous down, oblique; G. reddish, then tan, subdistant, separate behind. Old stumps. C. $4 \times 1\frac{1}{4} \times \frac{1}{4}$.

**P. stypticus** Fr. (1444). P. cinnamon, becoming pale, reniform, pruinose, cuticle separating into furfuraceous scales; S. paler, dilated at the apex, ascending, pruinose; G. ochraceous or cinnamon, ending determinately, thin, very narrow, crowded, connected by veins; taste very astringent. Dead stumps etc. C. $1\frac{1}{2} \times \frac{3}{4} \times \frac{1}{4}$. Suspicious.

Said to be luminous.

## LIV. XEROTUS Fr.

(Greek *xeros*, dry, *ous*, an ear.)

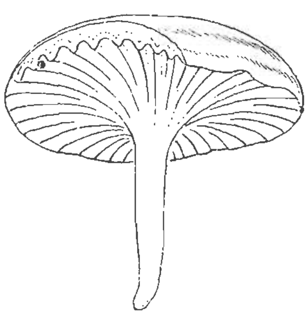

Fig. 59.—*Xerotus deneger* Fr. (Nat. size.)

*Xerotus* is analogous to *Cantharellus*, but differs in its leathery substance. The cap is coriaceous, membranous, and regular; the stem is central; the gills are adnato-decurrent, coriaceous, broadly fold-like, dichotomous, with entire obtuse edge. The single British species grows on the ground.

**X. deneger** Fr. (1448). P. date-brown-grey and striate when moist, grey and floccu-lose when dry, subzonate, very thin, very tough, plano-infundibuliform; S. fuscous, somewhat white velvety; G. whitish-grey, few, very distant, flaccid. Bare gravelly soil etc. R. $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{8}$.

## LV. TROGIA.

(After J. G. Trog, a Swedish botanist.)

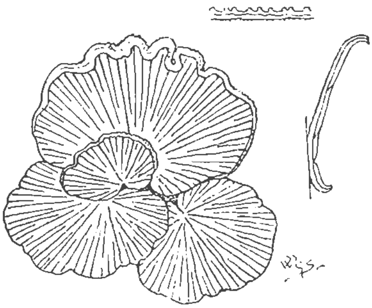

Fig. 60. *Trogia crispa* Fr., entire and in section. (Nat. size.)

In *Trogia* the cap is spongy coriaceous, soft, flaccid, arid, persistent, fibrillose in texture and sessile or substipitate; the gills are arid, fold-like, venose, and, in the single British species, the edge is obtuse and crisped; the spores are white. Growing on wood.

**T. crispa** Fr. (*Plicatura*) (1449). – P. light yellow rufescent, whitish at the margin, cup-shaped, sessile or substipitate, then reflexed, often lobed, villose, subzonate; G. white or bluish grey, dichotomous, narrow, very much swollen. Logs. O. 1 in. diam.

The plants roll up irregularly when dry and so protect the gills.

## LVI. SCHIZOPHYLLUM Fr.

(Greek *schizo*, to split, *phyllon*, a leaf –from the split gills.)

In *Schizophyllum* the cap is thin and coriaceous and the stem lateral or absent; the gills radiate from a central point and become longitudinally split and revolute at the edge; the spores are pinkish in the mass. The single British species grows on wood.

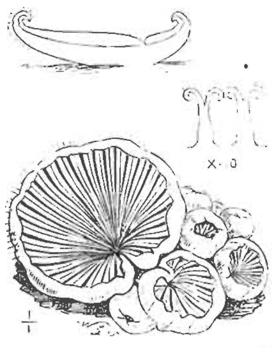

Fig. 61. –*Schizophyllum commune* Fr. (Nat. size.)

**S. commune** Fr. (1450). P. greyish or flesh-colour, becoming white, reniform, often much lobed, very arid, pendulous, commonly extended behind into a stem-like base, covered with grey down, then strigose; G. fuscous grey, then purplish or whitish, narrow. Fallen logs, timber yards, etc. F. 2 in. diam.

*Schizophyllum* is unique amongst Agarics in having gills which are either partially or completely divided down their median planes into two parts. In moist weather the gills point vertically downwards, and spore discharge takes place for several days. When desiccation of the fruit-body sets in, the emission of spores soon ceases and the two halves of each gill begin to diverge below. When quite dry the largest gills completely cover in the shorter ones and thus the hymenium is sheltered. In this condition the fungus can retain its vitality for a number of years, and even withstand the lowest temperatures known. The cap is of an absorbent nature, the hairs enabling it to take up moisture with great avidity; drops of water falling on it are absorbed without splash up to the point of saturation. On being moistened, the gills at once begin to unroll. The opening and closing can be partially explained from the fact that the trama is composed of longitudinal hyphae with very thick walls, which are strongly attached to one another at intervals. The hymenium and subhymenium, on the other hand, are composed of elements with very thin walls.

## LVII. LENZITES Fr.

(After H. O. Lenz, a German botanist.)

In *Lenzites* the cap is corky or coriaceous, dimidiate or resupinate, sessile; the stem is lateral or absent; the gills are coriaceous, firm, sometimes simple and unequal, sometimes anastomosing behind and forming pores. Growing on wood, often imbricate. There are about five British species.

*Lenzites* is most nearly allied to *Trametes* and *Dædalea*.

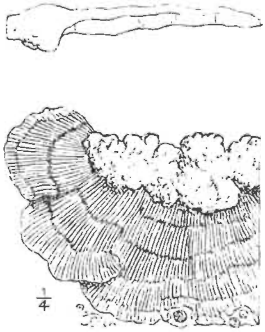

Fig. 62.—*Lenzites betulina* Fr. (× ¼.)

**L. betulina** Fr. (1451). P. whitish grey, becoming pale, firm, rigid, dimidiate, sessile, becoming plane, sometimes resupinate, tomentose, frequently subzonate, the zones sometimes darker; G. dingy white, reaching the base, simple, branched, or anastomosing, edge acute. Birch stumps etc. C. 8 in. diam.

The pileus is often green with unicellular algæ.

**L. flaccida** Fr. (1452). P. whitish, then dingy, with concolorous zones, thin, unequal, dimidiate, sessile, strigosely hairy; G. shining white, becoming pale, thick, firm, straight, very broad, simple or branched at the base, with shorter ones intermixed. Beech stumps. C. 4 in. diam.

Pileus often green as in 1451.

**L. sæpiaria** Fr. (1453). P. yellow-tawny, then date-brown except at the margin, becoming black when old, corky coriaceous, dimidiate, lateral, convex, then plane, zoned, strigosely tomentose, finally squamulose and pitted; G. yellowish, then umber, extended to the base, very rigid, branched, somewhat anastomosing, edge entire or slightly toothed. Coniferous stumps etc., worked wood. F. 5 in. diam.

Very destructive to worked wood.

## Family 2.—POLYPORACEÆ.

In this family the hymenium lines the surface of tubes, pores, or reticulations; these are usually round or angular, occasionally sinuate or torn. The substance may be fleshy, leathery, or woody. A central or excentric stem is present or the fruit-body may be sessile or resupinate; the hymenium in resupinate forms is superior, in the others inferior.

Spore-discharge can be seen taking place from many of the larger forms in sun-light. The process is continuous for several months.

### *Key.*

I. Hymenium lining the interior of tubes or pores.

A. Tubes forming a distinct layer.

*a.* Tubes easily separable from the flesh.

1. Tubes separate throughout their length ............ *Fistulina.*
2. Tubes coherent ............ 3.
3. Cap with large black imbricate scales ............ *Strobilomyces.*
   Cap not scaly ............ *Boletus.*

*b.* Tubes not easily separable from the flesh.

4. Resupinate; membranous; pores superior ............ *Poria.*
5. Stipitate or sessile ............ 6.
6. Tubes in a single layer; fleshy to leathery ............ *Polyporus.*
   Tubes stratose; woody to corky with a hard crust... *Fomes.*

B. Tubes not forming a distinct layer.

7. Tubes very short; pores round or angular ............ *Polystictus.*

8. Tubes of different lengths ............................. 9.
9. Pores rounded, more or less elongated radially ...... *Trametes*.
Pores irregular, sinuous, or labyrinthine ..................... *Dædalea*.
II. Hymenium spread over very shallow gyrose pores.
10. Resupinate; subgelatinous ................................ *Merulius*.
III. Hymenium lining the interior of distinct papillæ.
11. Resupinate; membranous ................................ *Porothelium*.

## LVIII. BOLETUS Dill.

(Greek *bolos*, a clod—from the shape of the cap.)

The cap is fleshy, the stem central and fleshy, frequently ventricose or bulbous, and sometimes annulate; the closely packed tubes are distinct from the flesh of the cap and from one another. Terrestrial. There are about seventy British species, the majority of which are edible.

Several species have been reported as forming mycorrhiza with the roots of trees (*cf.* p. 9). The flesh of many species turns blue when exposed to the air (*cf.* p. 10).

*Hypomyces* (*Sepedonium*) *chrysospermus*) frequently attacks the members of this genus, forming brilliant yellow masses principally over the tubes; *Syzygites megalocarpus* (*Sporodinia grandis*) is also a frequent parasite.

Probably all species are edible, but they should be eaten young.

The genus has been much subdivided in recent years according to the length and shape of the tubes and the colour of the spores.

I. Tubes long; pores round or angular.

*a.* Spores ochraceous, ferruginous, or olivaceous.

i. Tubes usually yellow.

* *Pileus viscid; stem not bulbous nor reticulate.*

115. **B. luteus** Linn. (1456). (Latin *luteus*, yellow.)

Fig. 63.—*Boletus edulis* Bull. (× ¼.)

Cap covered at first with a separable brown gluten, which eventually disappears, leaving the surface paler, gibbous, then pulvinate; stem whitish, becoming fuscous below the ring, apex light yellow and granular, equal, firm; ring cream-colour, becoming fuscous, large; tubes yellow, adnate, pores yellow, small, round; flesh whitish or yellowish; taste pleasant.

Coniferous woods. Common. June to Dec. $5 \times 2\frac{3}{4} \times 1$. Edible.

**B. elegans** Schum. (1457).—P. golden; S. golden, then rufescent, unequal, apex reticulate with granules; R. cream, often torn and fugacious; T. sulphur to bright yellow, decurrent, pores angular; flesh light yellowish. Coniferous woods. C. $4 \times 2\frac{3}{4} \times 1$. Edible.

**B. flavus** With. (1458).—Differs from 1457 in the T. being adnate, the pores greyish yellow and larger, and the paler flesh becoming pink. Coniferous woods O. $4 \times 3\frac{1}{2} \times 1$. Edible.

**B. flavidus** Fr. (1459).—P. brownish yellow or yellowish buff; S. whitish tinged with yellow, minutely glandular above the R., mealy, base white, cottony; R. gelatinous, greenish white with floccose viscid margin; T. dingy yellow, decurrent, with large angular compound pores. Pine woods. O. $2 \times 2 \times \frac{1}{4}$. Edible.

**B. collinitus** Fr. (1460).—P. chestnut, then pale, covered at first with fuscous gluten, convex, pulvinate: S. white, becoming fuscous, attenuated downwards, subreticulate with adpressed squamules; T. pallid, then yellow, adnate, elongated, pores rather large, divided into two. Pine woods. R. 4×2½×1¼. Edible.

116. **B. granulatus** Linn. (1461). (Latin *granulatus*, granulated.)

Cap yellowish, covered with ferruginous-brown gluten, convexo-expanded, smooth; stem yellowish, cylindrical, somewhat attenuated downwards, rather short, dotted above with honey-coloured granules, cottony below; tubes sulphur-yellow, adnate, short, pores subcircular, in early stages exuding a thin gummy juice which appears to granulate on drying; flesh yellowish; taste pleasant.

Coniferous woods. Common. May to Dec. 4×2¼×1. Edible.

Regarded by some authors as being merely a ringless form of *B. luteus*.

**B. tenuipes** Mass. (1462).—P. yellowish brown or gilvous, convexo-pulvinate, viscid, streaked with minute fibrils when dry; S. yellow, attenuated at the base, smooth; T. yellowish, adnate, shortened round the S., pores rather large, angular; flesh white, rosy under the cuticle. Woods etc. O. 2×2¾×⅜. Edible.

117. **B. bovinus** Linn. (1463). (Latin *bovinus*, pertaining to oxen—from the colour.)

Cap reddish yellow to reddish ferruginous, viscid, pulvinate to flat, margin white, involute, and overlapping the tubes; stem concolorous, equal or a little swollen at the whitish base; tubes yellowish, then greenish to dark olive or brown, subdecurrent, shallow at first, orifice of pores compound, toothed; flesh whitish, reddish under the cuticle of the cap, cobalt-blue over the tubes.

Common. Aug. to Nov. 4½×2½×½. Edible.

**B. badius** Fr. (1464).—P. bay-brown, hemispherical, pulvinate, viscid, then pubescent, often shining when dry; S. paler, subequal, brown pruinate; T. light yellow to greenish yellow, becoming immediately bluish green when bruised, adnate or sinuato-depressed, long; pores angular, rather large: flesh yellowish, cobalt-blue over the T. when cut. Pine woods etc. C. 5×4×1½. Edible.

118. **B. piperatus** Bull. (1468). (Latin *piperatus*, peppery.)

Cap dull ochraceous orange, convexo-plane, smooth, slightly viscid; stem concolorous, slender, fragile, equal or attenuated downwards, arising from a yellow mycelium, base containing yellow milk; tubes bright ferruginous red, decurrent, pores large, angular, often toothed; taste peppery; flesh deep sulphur-colour, orange in the stem.

Woods and heaths. Common. Aug. to Nov. 5½×3×1. Edible.

** Pileus villose when young: stem not bulbous nor reticulate.

119. **B. sanguineus** With. (1473). (Latin *sanguineus*, blood-red.)

Cap blood-red or crimson, becoming brownish at the disc, convex, then plane, dry, almost velvety; stem yellowish, streaked or blotched

with dilute crimson or brown, with traces of long crimson reticulations at the apex, base subbulbous; tubes dull ochre or golden yellow, becoming bluish or greenish when bruised and finally orange, adnate or slightly depressed round the stem, pores angular, medium in size; flesh yellow, then rosy, becoming bluish when cut or broken; taste somewhat acrid.

Woods and pastures. Rare. July to Sept. 4 × 3 × 1.

120. **B. variegatus** Swartz (1469). (Latin *variegatus*, variegated.)

Cap dark yellow or ochraceous, sprinkled with superficial, separating, fasciculate, hairy squamules, convex, then plane, slightly moist, margin acute, extended beyond the tubes, flocculose at first; stem deep yellow or reddish, firm, equal, even, base white; tubes yellowish to brown and olive-brown, finally cinnamon, adnate, pores round; flesh yellow, changing sparingly or wholly to blue; smell unpleasant.

Coniferous woods and heaths. Common. July to Nov. $5\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$. Edible.

**B. sulphureus** Fr. (1470).—Wholly sulphur-colour. P. silky tomentose; S. finally dingy ferruginous, ventricose, arising from a golden woolly mycelium; T. becoming spotted ferruginous, and finally green, adnate, short, pores minute, compound; flesh becoming blue when broken, then golden yellow. Cæspitose on pine sawdust and twigs. O. $4 \times 2 \times 1\frac{1}{4}$. Edible.

121. **B. subtomentosus** Linn. (1474). (Latin *sub*, somewhat, *tomentosus*, downy.)

Cap golden brown to olivaceous brown, convex, then pulvinato-expanded, soft, dry, villoso-tomentose, often cracked, showing yellow interstices; stem bright yellow usually striated with crimson, firm, somewhat slender, attenuated below, ribbed sulcate, the tawny ribs sometimes anastomosing, slightly scabrous; tubes golden yellow, adnate, pores large, angular; flesh yellowish white, brownish under the cuticle, sparingly changing to blue over the tubes; taste mild.

Woods, heaths, and pastures. Common. July to Dec. $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{7}{8}$. Edible.

**B. chrysenteron** With. (1472).—Differs from 1474 *principally in the flesh* of the P. being red under the cuticle and the interstices showing red on cracking. Woods etc. C. $3 \times 3 \times \frac{1}{2}$. Edible.

**B. spadiceus** Fr. (1475).—Differs from 1474 in the date-brown P. which becomes widely cracked, in the yellow flocculoso-furfuraceous S. which becomes fuscous, with thin, tawny, anastomosing ribs, and in the round toothed pores. Woods. O. $5 \times 3 \times 1\frac{1}{4}$. Edible.

*** Pileus pruinose when young; stem not bulbous nor reticulate.

**B. versicolor** Rostk. (1478).—P. blood-red or clear rose-pink, becoming tawny at the disc, convex, then plane, minutely tomentose; S. yellow, rose-red *in the* middle and at the base, becoming blue when rubbed, slightly viscid in wet weather, minutely granular or pruinose; T. yellow, becoming blue when touched, adnate, decurrent by a tooth; flesh yellow, reddish at base of S., changing to blue when cut. Woods etc. F. $3 \times 2 \times \frac{1}{4}$. Edible.

**B. parasiticus** Bull. (1481).—Is distinguished by growing parasitically on *Scleroderma vulgare* (No. 170) and *S. verrucosum* (No. 171). P. yellowish brown. convex, then plane, minutely tomentose, often cracked in a tessellated manner: S. yellow, attenuated at the base, incurved, subfibrillose, apex mealy: T. yellow, then vinous, decurrent, short, pores compound. F. 2×2×½.

**** Stem stout, bulbous at first, reticulate; reticulations usually red.

122. **B. pachypus** Fr. (1488). (Greek *pachus*, thick, *pous*, a foot.)

Cap fuscous, then pallid tan, convex, pulvinate, slightly velvety, margin at first incurved, exceeding the tubes; stem variegated yellow and red, often wholly blood-red, frequently with a rosy-purple zone at the apex, reticulated with white veins, firm, ovato-bulbous, then elongated; tubes bright yellow, then greenish, free, long, shortened round the stem, pores round, becoming spotted with green: flesh yellowish, changing to azure-blue on being broken, red at the base of the stem.

Woods, chiefly pine. Uncommon. Sept. to Oct. 4×3×1.

**B. appendiculatus** Schaeff. (1482).—Differs from 1488 in the brown to reddish P., the sulphur-yellow, ventricose, rooting S., with the apex minutely reticulated with white veins and often pink towards the base, and in the adnate T. Woods. O. 4×4×1. Edible.

**B. calopus** Pers. (1484).—Differs from 1488 in the olivaceous P. with straight margin, the scarlet S. often with a yellow apex, and in the yellow adnate tubes with angular pores becoming bright green. Coniferous woods. F. 4×3×1¼. Edible.

**B. olivaceus** Schaeff. (1485). Differs from 1488 in the olivaceous-fuscous P., the red or pale citron-yellow, clavate, bulbous, or fusiform S. with yellowish apex reticulated with white veins and base with pink granulations, and in the adnate T. becoming olivaceous. Beech woods. O. 3×2×¾.

**B. regius** Kromb. (1486). –P. bright rose-pink, reddish purple, or olivaceous, pulvinate; S. pale yellow becoming purplish at the base, reticulate; tubes golden yellow, almost free, short, pores small, subangular. Woods etc. O. 5×5×1½. Edible.

***** Stem stout, bulbous; reticulations (when present) never red.

123. **B. edulis** Bull. (1490). (Latin *edulis*, eatable.)

Cap light brown, bay, or chestnut, rarely whitish or grey-brown, the margin often white, convex, pulvinate, smooth, often rugose, moist: stem pale brown, with fine white reticulations at the apex, stout, equal or attenuated upwards from the swollen base: tubes white to yellowish green, almost free, elongate, pores small, round; flesh white, often with a trace of pink under the pellicle: smell and taste pleasant.

Woods, especially beech. Common. June to Nov. 8×5×2. Edible.

This is the cèpe of French markets. It is best for the table just before the tubes become greenish. The tubes should be removed: the stem, if retained, should be cut into thin slices.

**B. reticulatus** Boud.- Differs from 1490 in its paler tomentose P. and in its S. being reticulated to the base. Deciduous woods. F. 8×5×2. Edible.

**B. pinicola** Rea Differs from 1490 in having its P. and S. a rich chestnut-colour. P. viscid when moist, then dry and floccose. Coniferous woods. F. 8×5×2. Edible.

**B. candicans** Fr. (1489).—P. and S. whitish or pale tan-colour; P. convex, subtomentose, then smooth; S. delicately reticulated, ventricose or bulbous; T. lemon-yellow, adnate or sinuate, pores white, then lemon-yellow, rounded: flesh white, becoming blue when broken. Woods etc. O. 6×3×1½.

**B. aereus** Bull. (1491).—Differs from 1490 in its very dark olivaceous-brown, almost black, pubescent or villose P., and short, white, then sulphur T.; S. yellowish, becoming fuscous downwards, reticulations concolorous. Woods. O. 5×4×1½. Edible.

**B. vaccinus** Fr. (1493).—Differs from 1490 in the minutely tomentose chestnut P., in the concolorous S. without reticulations, and in the much smaller pores. Woods. O. 2½×2×¾. Edible.

**B. fragrans** Vitt. (1495).—P. fuscous-umber, pulvinate, repand, subtomentose, margin incurved; S. variegated yellowish and red, ventricose, often fusiform-rooted; T. yellow, sinuato-free, pores round; flesh yellow, sometimes becoming greenish; smell fragrant. Woods etc. O. 5×3×1½. Edible.

**B. impolitus** Fr. (1496).—P. yellow-brown, pulvinate, flocculose, finally granuloso-rivulose, sometimes cracking into areolæ; S. yellow, often tinged with brownish red, which forms a ring-like zone at the apex, pubescent, clavate; T. pale lemon-yellow, then olivaceous green, depressed near the S., pores small, round; flesh whitish yellow; smell pleasant. Woods. O. 5×4×1½. Edible.

**B. æstivalis** Fr. (1497).—P. whitish, shaded pale buff, yellowish, or brownish, convex to expanded, smooth, granular in dry weather; S. light yellow, clavate, smooth or minutely reticulate; T. yellow or greyish, nearly free, long, pores minute, round; flesh yellow, reddish at base of S., white above. Woods etc. O. 6×4×2. Edible.

****** Pores red to reddish brown.

124. **B. satanus** Lenz (1498). (Greek *Satanus*, the devil—from the fancied evil properties.)

Cap pale brownish tan, becoming whitish, globose, then convex, pulvinate, subviscid, smooth; stem pink, brick-red to dark blood-red or brownish below, lighter and gradually passing to yellow above, reticulated with blood-red veins, ovato-ventricose; tubes yellow, free, pores blood-red, then orange, and finally sometimes olive-brownish, becoming dark greenish blue when touched, minute, round; flesh white, then cream-colour, becoming bluish when broken, reddish at the base of the stem.

Calcareous woods. Uncommon. July to Oct. 6×3×3. Suspicious.

125. **B. luridus** Schaeff. (1499). (Latin *luridus*, lurid.)

Cap dark brown or olive-brown, with a greenish shimmer, hemispherical, convex, then plane, tomentose, then smooth, viscid in damp weather; stem yellow, orange-red, or orange-brown, reticulated with blood-red veins, globose at first, then equal or swollen at the base; tubes yellow, finally becoming green, free, pores vermilion, then orange, small, round; flesh yellow, reddish at the base of the tubes and at the base of the stem, becoming immediately bright blue when broken, the blue colour soon fading to yellow.

Deciduous woods etc. Common. May to Dec. 4×4×1¾. Suspicious.

**B. erythropus** Quél.—Differs from 1499 in its equal, elongated, tomentose S. with red punctations, and in its usually smaller size; the flesh of the lower portion of the S. usually becomes red on exposure to the air. Coniferous woods. F. 3×3×1½. Edible.

**B. purpureus** Fr. (*1500*). Differs from 1499 in its purplish-red or violet, somewhat velvety P., in the purple reticulations and punctations of the S., and in the T. being light yellow, then greenish, with purple-orange pores. Woods etc. O. $4\frac{1}{2}\times4\times1\frac{1}{2}$. Edible.

ii. Tubes at first white or grey.

* Tubes *subdecurrent: pores large, angular, unequal.*

**B. viscidus** Linn. (1503) (*B. laricinus* Berk. (1501).—P. dingy white or dingy yellowish, with livid stains, convex, viscid, floccose, rugose: S. white, then yellow or greyish, viscid, floccose, apex reticulate, annulate; R. white, membranous, large; T. white, then greyish or greenish, subdecurrent, pores large, unequal, compound. Coniferous woods, especially under larches. C. $4\times2\frac{1}{2}\times\frac{1}{2}$. Edible.

** Tubes free, ventricose: pores minute, round, equal.

126. **B. versipellis** Fr. (1505). (Latin *versipellis*, changeable in appearance.)

Cap rufous, hemispherical, pulvinate, dry, at first compact and velvety, then scaly and becoming even, margin often appendiculate with the remains of the membranous fugacious veil; stem whitish, rough with small, rufous, later grey to blackish scales, sometimes imperfectly granuloso-annulate, attenuated upwards; tubes dingy white, free, long, pores dingy white, then grey, minute, round; flesh whitish, often greenish under the cuticle of the stem.

Woods, heaths, and pastures. Common. July to Nov. $4\frac{1}{2}\times6\times1\frac{1}{2}$. Edible.

127. **B. scaber** Bull. (1506). (Latin *scaber*, rough.)

Cap light brown to dark brown or grey, varying orange, rarely blackish or whitish, hemispherical, pulvinate, smooth, viscid when moist, at length rugulose or rivulose, margin at first cortinate; stem whitish or greyish, striated and sprinkled with minute grey fibrous scales, which become blackish with age, sometimes imperfectly granuloso-annulate, elongate, attenuated upwards; tubes white, then dingy, free, long, pores minute, round; flesh white.

Woods. Common. May to Dec. $4\frac{1}{2}\times7\frac{1}{2}\times1$. Edible.

**B. nigrescens** Roze & Rich. Differs from 1506 in the yellowish tomentose cap, which cracks with age, the yellowish ventricose S., the T., which are at first white, then bright yellow, and in the yellowish-white flesh, which on breaking becomes at first red and then dark brown. Deciduous woods. O. $4\times3\frac{1}{2}\times1\frac{1}{2}$. Edible.

**B. rugosus** Fr. (1506 *a*).—Differs from 1506 in its bay or brown dry P., its whitish or ochraceous S. with dark longitudinal anastomosing ribs and reticulations, its whitish then ochraceous T., and its flesh being reddish under the cuticle of the P. Woods. O. $2\frac{3}{4}\times5\times1\frac{1}{4}$. Edible.

**B. duriusculus** Schulz. (1507).—Differs from 1506 in the grey-fuliginous or grey-bistre minutely tomentose P. often areolately cracked when dry, in the very firm S., with dense black striæ and punctations which often anastomose to form reticulations, and in the flesh becoming reddish, then blackish when broken. Woods etc., especially under poplars. O. $4\times7\times1$. Edible.

*b.* Spores brownish purple (*Phæoporus*).

**B. porphyrosporus** Fr. (1504).—P. olivaceous or brownish fuliginous, becoming blackish when bruised, convex, minutely velvety; S. concolorous, attenuated upwards from the thicker, paler base, velvety; T. pale grey or olivaceous, adnate, pores yellowish, becoming bluish green when bruised, broad, angular, staining white paper green; flesh dingy white, becoming bluish or fuliginous; smell strong. Woods etc. O. $5\times4\frac{1}{2}\times1\frac{1}{4}$. Edible.

*c.* Spores pink (*Tylopilus*).

**B. felleus** Bull. (1509). (Latin, *fel*, gall—from the bitter taste.) Cap pale yellowish or pale brown, clouded darker, pulvinate or hemispherical, then expanded, sometimes slightly depressed, fleshy, slightly mealy, then smooth; stem somewhat paler than the cap, brown reticulate above, enlarged below; tubes white, becoming salmon-colour, adnate, convex, long, pores white, then pinkish, fairly broad; flesh becoming pinkish.

Woods, especially on calcareous soil. Not uncommon. July to Dec. $4\frac{1}{2} \times 4 \times 1$. Suspicious.

*d.* Spores white or pale yellowish (*Gyroporus*).

**B. cyanescens** Bull. (1511). P. subfuscous or tan, convexo-expanded, adpressedly tomentose, floccosely scaly; S. concolorous, ventricose, villoso-pruinose, stuffed, then hollow; T. white, finally light yellow, blue when bruised, free, minute, round; flesh white, instantly becoming deep indigo-blue when broken and emitting an azure-blue juice when compressed. Woods. O. $3 \times 3 \times 1$. Edible.

**B. castaneus** Bull. (1512).—Differs from 1511 in its cinnamon or chestnut, minutely velvety P. and S., and in its white flesh not changing colour. Woods. F. $3\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{4}$. Edible.

**B. fulvidus** Fr. (1513).—Differs from 1511 in the yellowish or brownish orange, smooth, shining P. and S., and in the white flesh becoming yellowish. Under trees. O. $3 \times 2\frac{1}{2} \times \frac{1}{2}$. Edible.

II. Tubes short, subadnate; pores sinuous or gyroso-plicate; spores olivaceous (*Gyrodon*).

**B. Sistotrema** Fr. (1514*a*).—P. reddish or brownish olive, convex, then flattened, glabrous; S. pale lemon-yellow or becoming reddish, smooth; T. yellow tawny or pale sulphur, adnate, very short, pores yellow, becoming tawny, sinuous, becoming gyroso-plicate. Coniferous woods. R. $3 \times 3 \times \frac{3}{4}$. Edible.

III. Tubes short, decurrent; pores alveolar; spores yellow (*Boletinus*).

**B. cavipes** Opat. (1515*a*).—P. tawny or brownish tawny, convex, subumbonate, fibrillosely scaly; S. lemon-yellow and reticulate above the R., concolorous and scaly below, thickened at the base and rooting; R. white, floccose, thick, evanescent; T. yellow, becoming greenish or olivaceous, compound, broad, honey-comb-like, decurrent. Under larches and on mossy beech trunks. R. $3 \times 3\frac{1}{2} \times \frac{3}{4}$. Edible.

## LIX. STROBILOMYCES Berk.

(Greek *strobilos*, a pine cone, *mukes*, a fungus—from the appearance of the cap.)

*Strobilomyces* differs from *Boletus* in the cap being covered with imbricate scales and in having blackish or fuscous spores. There is a single British species.

**S. strobilaceus** Berk. (1516).—P. white, becoming brownish or blackish, pulvinate, then convex, broken up into large, thick, floccose scales; S. concolorous, apex white, sulcately reticulated, floccosely scaly below the white, floccose, thick R.; T. white, becoming brownish, long, pores white, becoming reddish when bruised; flesh white, becoming reddish, then blackish bistre. Woods. O. $6 \times 7 \times 1\frac{1}{4}$.

## LX. FISTULINA Bull.

(Latin *fistulina*, a small pipe—from the character of the tubes.)

The cap is fleshy, juicy, subgelatinous in the upper layer; the stem is lateral or absent; the tubes are distinct and free from each other, not longitudinally adpressed and conjoined; the spores are pink. The single British species grows on wood.

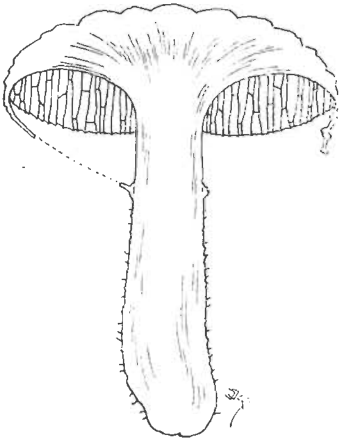

Fig. 64. Section of *Strobilomyces strobilaceus* Berk. (× ½.)

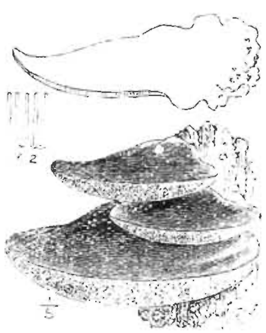

Fig. 65. *Fistulina hepatica* Fr. (× ½.)

128. **F. hepatica** Fr. (1517). (Greek *hepatikos*, of the liver—from its appearance.) Liver or Beef-steak Fungus.

Cap dull pale purplish red, blood-red, liver-colour, or chocolate, becoming blackish, roundish, dimidiate, or subspathulate, sessile or stipitate, rough, thick, fleshy, viscid; stem, when present, concolorous, punctate; tubes pallid, becoming reddish, separate, pores pale, round; flesh reddish, red-streaked like beet-root, fibrous, distilling a red juice; taste somewhat acrid, especially when young.

On trunks of trees, especially oak. Common. Aug. to Nov. 16 in. diam.

The fruit-body is first spherical and rapidly grows into a tongue-shaped structure, frequently imbricate, and sometimes attaining an enormous size and up to 30 lbs. in weight; in wet weather it may reach its full size in a fortnight. Unlike *Polyporus* it soon perishes, usually not lasting more than three weeks from its first appearance. It is best for eating when mature, as it is then more tender and less acid.

The developing fruit-body in its first stages bears conidia to the exterior. Sometimes this conidial condition continues and a brick-red asexual form, from two to three inches in diameter, results. In the mature plant conidia (chlamydospores) occur in large numbers immediately below the gelatinous outer layer.

## LXI. POLYPORUS Mich.

(Greek *polus*, many, *poros*, a pore.)

The cap is woody, corky, or somewhat soft; the stem is central, lateral, or absent, and may be either simple or branched; the tubes are connate with the substance of the cap and not separable from it nor from each another, and are not stratose; the pores are round or angular, entire, torn, or toothed. The species are annual or perennial, and usually grow on wood, many of them causing destructive diseases of trees. There are about seventy British species.

i. Stem simple, central, or excentric, not black at the base; pileus single.

Fig. 66.—*Polyporus squamosus* Fr. (× ½.)

**P. leucomelas** Fr. (1518).—P. black-fuliginous, convex, then expanded, often irregular and lobed, slightly silky squamulose; S. concolorous with pale apex, sometimes tuberous, subtomentose; T. white, decurrent. pores white, then grey. large, entire. then torn. Coniferous woods. R. 5×1×1. Edible.

**P. Schweinitzii** Fr. (1523).—P. bright tawny with yellowish-tawny margin, disc becoming date-brown. finally entirely fuscous, rugose, strigosely tomentose. fibrillose; S. ferruginous. strigose: T. greenish yellow. reddening when touched, decurrent, pores broad, angular, often irregular. exuding drops: flesh rhubarb-colour. then fuscous. Stumps and roots of conifers. C. 6×1¾×1½.

Causing "heart-rot" of conifers. The fungus enters the roots and grows up the stem. When growing on roots the stipe is central and the pileus regular. though frequently when two or three specimens grow together the pilei fuse. When growing on trunks the fruit-bodies are bracket-shaped and frequently imbricate.

**P. rufescens** Fr. (1524) (*Dædalea biennis* Quél.).—P. flesh-colour. whitish towards margin. depressed to infundibuliform, strigose or hairy; S. ferruginous, irregularly shaped. subcentral, lateral. or wanting. subtomentose; T. decurrent, pores white, then flesh-colour, pruinose. labyrinthiform or sinuate, at length torn. On and about stumps. F. 5×2×1.

**P. perennis** Fr. (1525).—P. cinnamon. then date-brown, hemispherical. plane or cyathiform. leathery. thin. zoned. velvety to smooth, with fimbriate, then entire margin; S. concolorous or tawny. attenuated upwards. base often bulbous. velvety, firm: T. tawny, decurrent. pores silvery. then tawny. minute. angular. acute, then torn. Burnt ground and about stumps. C. 2½×1¼×¼.

ii. Stem simple, eccentric. or lateral, base black; pileus single.

**P. squamosus** Fr. (1527).—P. ochraceous variegated with broad, adpressed. centrifugally arranged, dark brown scales, fan-shaped. flat, fleshy, pliant, often imbricate and flattened: S. ochraceous. base blackish, excentric, lateral or wanting. apex reticulate; T. whitish, becoming yellowish. adnato-decurrent. short, pores minute, then large. angular and torn: smell strong. Trunks. C. 16×2×2. Edible.

When growing in the dark no pileus is produced. but the stipe elongates into staghorn-like structures. The fungus is a wound-parasite, and causes a "heart-rot": affected wood shows a "black line" similar to that caused by *Armillaria mellea* (cf. p. 33).

**P. picipes** Fr. (1531).—P. pallid, then chestnut or yellowish, with chestnut disc, cyathiform, fleshy coriaceous, then rigid, smooth, margin scalloped: S. brownish bistre or olivaceous, black punctate up to the pores, excentric or lateral, pruinosely velvety, becoming smooth: T. white, then yellowish, decurrent, pores white, then yellowish or pinkish, minute, round. Willow stumps. C. $7 \times 1\frac{3}{4} \times \frac{3}{8}$.

**P. Varius** Fr. (1532).—Differs from 1531 in the pallid ochraceous, then tan, somewhat virgate P., in the smooth S. pale ochraceous at the apex, and in the whitish T. becoming ochraceous or cinnamon. Stumps etc. C. $3 \times 2 \times \frac{3}{8}$.

**P. nummularis** Quél.—Differs from 1531 in the whitish-cream, then ochraceous, thin, convexo-plane P., and in the pruinose S. whitish cream at the apex. Twigs etc. C. $1 \times \frac{3}{4} \times \frac{1}{4}$.

## 129. **P. lucidus** Fr. (1535) (*Ganoderma*). (Latin *lucidus*, shining.)

Cap light yellow, then blood-red-chestnut, subreniform, sometimes flabelliform, rarely orbicular, sometimes sessile and imbricate, polished, shining, sulcato-rugose; stem concolorous, lustrous, lateral, rarely central, sometimes wanting, hard, rugose; tubes white, then cinnamon, adnate, pores white, then discoloured, minute, round; flesh whitish, at length reddish, spongy at first, then corky and woody, zoned.

At the base and on the roots of trees. Common. July to April. $7 \times 6 \times 1\frac{1}{4}$.

This fungus has been found preserved in peat beds in the fens of the eastern counties; it is also recorded, together with *Fomes igniarius*, *F. fomentarius*, and *Dædalea quercina* from the lake-side pile-dwellings of Switzerland and Italy.

iii. With many branching stems from a common trunk; pileoli numerous.

**P. umbellatus** Fr. (1536).—P. fuliginous, rufous, or pallid light yellow, rarely white, convex, umbilicate, entire, pruinose or villose: S. white, branched, arising from a common stalk, each branch giving rise to a separate P., pruinose; T. white, decurrent, pores white, minute; smell pleasant. On and about old stumps. F. $1\frac{1}{2} \times 1\frac{1}{4} \times \frac{1}{4}$. Mass 10 in. diam. Edible.

Often arising from a large blackish branched sclerotium (*Sclerotium giganteum* Rostr.) about an inch thick. Bommer describes an example which occupied a *square metre*.

**P. frondosus** Fr. (1537).—Differs from 1536 in the fuliginous grey or tan, dimidiate P., which is spathulate, lobed, intricately recurved, often with a white margin, in the sparingly branched smooth S., in the pores becoming denticulate, and in the smell of meal. On stumps. F. $4 \times 2 \times \frac{3}{4}$. Mass $10\frac{1}{2}$ in. diam. Edible.

**P. intybaceus** Fr. (1538).—Differs from 1537 in the yellowish to greyish-brown, much branched, and lobed P., in the S. gradually spreading and dividing into the lobes of the P., in the pores becoming fuscous, and in the smell of mice. Stumps. F. $3 \times 2 \times \frac{1}{2}$. Mass $12 \times 7$. Edible.

**P. cristatus** Fr. (1539).—Differs from 1537 in the reddish-green or greenish-yellow, somewhat thick, depressed, villose, then cracked, scalloped P., in the white or lemon-yellow, irregular, connate S., and in the absence of smell. Beech woods. R. P. $3\frac{1}{2}$. Mass 8 in. diam. Edible.

**P. giganteus** Fr. (1540).—P. date-brown, disc finally black, densely imbricated, *very broad, flaccid, subzoned, rivulose, becoming squamoso-fibrillose*: S. whitish, connato-branched from a common tubercle: T. whitish, decurrent, pores becoming blackish when touched, minute: flesh white, becoming black; smell sour. Stumps. C. P. $8\frac{3}{4}$. Mass 9 in. diam.

iv. Pileus sessile, dimidiate or effuso-reflexed.

130. **P. sulphureus** Fr. (1543). (Latin *sulphureus*, like sulphur.)

Cap reddish yellow or orange, becoming paler with age, pruinose, imbricated, undulated, sessile, rarely stalked; tubes sulphur-yellow, becoming paler, pores minute, round; flesh light yellowish, then white, often exuding a sulphur-yellow liquid when broken; taste acrid.

On tree-trunks. Common. Mar. to Nov. Pileus 7½. Mass 9½ in.

The fungus is a wound-parasite, establishing itself on wounds or dead branches, and thence gaining admittance to the heart-wood of the main stem, where it causes a characteristic "heart-rot." Conidia are frequently formed by the mycelium in the vessels of the wood.

The fungus has been reported to be luminous.

131. **P. cæsius** Fr. (1557). (Latin *cæsius*, bluish grey.)

Cap white, then tinged with bluish grey, dimidiate, often imbricate, rarely stipitate, sometimes resupinate, villose or silky; tubes white, pores becoming bluish grey when touched, small, unequal, flexuose, toothed; flesh white, bluish when broken, soft, watery, then firm; spores pale blue.

Stumps and dead branches, usually of conifers. Common. March to Dec. 4½ in. diam.

**P. nidulans** Fr. (1560).—P. pale yellowish or flesh-colour, pulvinate, solitary, convex above and below, villose, then smooth, margin spreading and obtuse; T. cinnamon, pores becoming purplish when bruised, rather large, angular; flesh pale cinnamon, very soft, giving a blue juice when treated with alcohol; fragrant when dry. Twigs etc. F. 1 in. diam.

**P. rutilans** Fr. (1561).—Differs from 1560 in its tawny-cinnamon or reddish-grey imbricate P., which is not convex below, with inflexed unequal margin, in the T. being white, then concolorous, in the pores being angular and the flesh concolorous; smell of anise. Branches etc. F. 1¾ in. diam.

**P. adustus** Fr. (1564).—P. cinereous pallid, becoming black at the margin, dimidiate, orbicular, imbricate, sometimes resupinate, villose, obsoletely zoned, slightly wrinkled; T. cinereous, short, pores white pruinose, then cinereous fuscous, blackish when dry, minute, round, obsolete at the margin, leaving a white border; flesh white, then grey or black, soft, floccose. Trunks etc. C. 3 in. diam.

**P. fumosus** Fr. (1563).—Differs from 1564 in the pale ochraceous, then fuliginous P., becoming black at the margin, sometimes at first minutely tomentose, in the whitish-cream, then smoky T., and in the whitish, hard, zoned flesh. Stumps etc. C. 2 in. diam.

**P. hispidus** Fr. (1569).—P. yellowish, then ferruginous, and finally blackish, dimidiate, pulvinate, thick, very hispid, shaggy; T. ferruginous, with yellowish, then concolorous pores, small, round, becoming torn, often exuding watery drops. Trunks. C. 10½ in. diam.

Wound-parasite, especially of ash.

**P. dryadeus** Fr. (1573).—P. yellowish, then ferruginous, becoming brown, dimidiate, pulvinate, imbricate, rugged to smooth, margin often exuding watery drops which become black in drying; T. ferruginous, pores whitish, round, small; taste acrid. Base of oak stumps. C. 9 in. diam.

132. **P. betulinus** Fr. (1574). (Latin *betula*, a birch—from the habitat.)

Cap pale umber whitish, becoming brownish with age, and often mottled, roundish or reniform, umbonate behind at the point of

attachment, sometimes prolonged into a short stalk, pellicle smooth, thin, separating, margin very obtuse, and sterile; tubes white, very short, often separating, pores white, becoming darker, minute, round; flesh white, soft, then corky.

On birch trunks, rarely on beech. Common. May to Jan. 8 in. diam.

The fungus causes a decay of the sap-wood. Sometimes the mycelium forms sheets like hard leather beneath the bark without producing fructifications (*Xylostroma giganteum* Tode).

The name "razor-strop fungus" is often given to *P. betulinus*, as up till the early part of last century it was used for making strops. A usual form for the strop was a piece of the fungus about 6×2×1 inches nailed to wood with the pore-bearing area upwards; the strop was surfaced with siliceous earth. Similar strops are made by the lumber-men in British Columbia and by the Macedonians (who also use strops of *Fomes igniarius*).

In the days of flint and steel it was much used on account of the persistent way in which it slowly smoulders if kept in a tin with restricted ventilation. According to Swanton, the charcoal is still valued as an antiseptic and disinfectant in the villages of south-west Surrey, where it is obtained by filling a tin canister with pieces of the fungus and placing in a slow fire until fumes cease to escape from the lid. In the same district "thin rectangular strips of the flesh, about 1½ by 1 inch, are kept as styptics, and similar strips with a circular hole about ½ inch in diameter punched through the middle are still employed as corn pads." Strips of the size and shape of a lead pencil are used for fuses for firing the charge when blowing timber. In the raw state they are called "slow touch," those that have been steeped in saltpetre solution are known as "quick touch."

## LXII. FOMES Karst.

(Latin *fomes*, touch-wood, tinder.)

*Fomes* is similar to *Polyporus*, but differs in the tubes being stratose. The cap is hard and woody from the first, often concentrically sulcate and covered with a hard, rigid, crustaceous cuticle. The species are perennial, growing on wood. There are twenty British species.

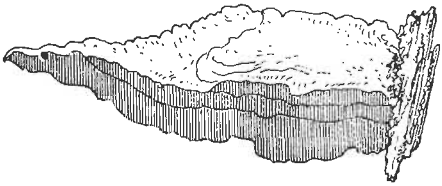

Fig. 67.—Section of *Fomes annosus* Cooke. (× ½.)

**F. applanatus** Karst. (1577) (*Ganoderma*).—P. cinnamon with white margin, becoming greyish, covered with a laccate crust, frequently dusted with the ferruginous spores, dimidiate or orbicular, often imbricate, flattened, attached by a broad base, rugged-sulcate-zoned; T. ferruginous, pores white, becoming brownish when bruised. Trunks. C. 12 in. diam.

**F. fomentarius** Karst. (1578).—P. greyish, becoming fuliginous, hoof-shaped, attached by a broad base, more or less triangular in section, cuticle very hard and thick, concentrically rugged-sulcate-zoned, pruinose; T. ferruginous, pores glaucous, pruinose, then ferruginous, minute, round; flesh rust-brown, soft, floccose. Trunks. C. 8 in. diam.

The fungus kills the cambium of deciduous trees, and causes a "white rot" of the sap-wood.

This is the fungus of amadou (soft amadou or German tinder) much used in former times as tinder (for catching sparks engendered by striking steel on flint). It was also employed as a styptic for staunching slight wounds, and for making soft surgical pads; it had its use in dentistry until comparatively recent years. Amadou is used on the continent for making picture-frames, ornaments, and such like. In certain regions, particularly Bohemia, caps, aprons, chest-protectors, and articles of dress are made from it. The woods of Thuringen are said to produce 1000 cwts. of tinder yearly. Amadou is prepared by freeing the flesh from the hard crust and the tubes, cutting it into slices and cooking several hours in lye or soaking in a solution of saltpetre. After drying, the substance is beaten until it becomes lax and spongy.

**F. igniarius** Karst. (1580).—Differs from 1578 in the floccosely hoary, then ferruginous, and finally blackish P. with the rounded obtuse margin white at first, in the cinnamon tubes which become whitish with deposits of lime when old, and the *cinnamon-brown, very hard flesh*. Trunks. C. 7 in. diam.

A wound-parasite causing a white "heart-rot" of deciduous trees. Hard amadou or touchwood is prepared from this fungus; it is much inferior to the soft amadou obtained from *F. fomentarius*.

**F. nigricans** Karst. (1579).—Differs from 1580 in the black, smooth, shining crust. Birches etc. C. 6 in. diam.

**F. pomaceus** Quél. Differs from 1580 in the fuscous, then cinereous P. being delicately silky, and in the light brown woody flesh. Plum and cherry. C. 2 in. diam.

In West Sussex used as a poultice for a swollen face. It is ground down on a nutmeg-grater and heated in the oven before application.

**R. Ribis** Cooke (1584).—P. ferruginous fuscous, bright yellow at the margin, becoming dark at the base, horizontal, imbricate, flattened, concentrically zoned, velvety, strigose; T. cinnamon, pores at first yellow, minute, round. Currants etc. F. 2½ in. diam.

**F. ulmarius** Cooke (1587).—P. white, becoming yellowish and discoloured with age, effused, flattened, tubercular, then smooth, with an obtuse margin, which is sometimes free; T. cinnamon, pores whitish, then yellowish, minute, round. Old elm trunks. C. 7 in. diam.

The cause of "heart-rot" and hollowness of elms.

**F. annosus** Cooke (1593).—P. bay-brown, becoming blackish, convex, then plane, imbricate, sometimes resupinate, rugoso-tubercular, sulcately zoned, silky, then with a rigid smooth crust, margin white at first, thin; T. yellowish, pores whitish. Base of conifer trunks etc. C. 7 in. diam.

The most important of the fungi causing "heart-rot" of conifers in this country.

## LXIII. POLYSTICTUS Fr.

(Greek, *polus*, many, *stiktos*, punctured.)

*Polystictus* is similar to *Polyporus*, but the substance is thin, the cuticle velvety or fibrillose, and the tubes are shallow and develop from the centre outwards. Growing on wood, often imbricate. There are about ten British species.

**P. radiatus** Cooke (*Polyporus*) (1595).—P. deep rich brown to dull orange, dimidiate, much imbricated, radiately rugose, minutely velvety, then smooth, margin yellow, spreading, repand; T. ferruginous, pores silvery, glistening, minute. Alder etc. C. 4 in. diam.

**P. versicolor** Fr. (1603).—P. variously coloured, dimidiate, often imbricate, velvety or pubescent, with concentric, smooth, shining zones of various colours; T. white, pores becoming yellowish, small, round, then torn and irregular. Trunks etc. C. 6 in. diam.

Very destructive to hardwood timber in yards.

The tubes are sometimes bright orange or vermilion from the growth of *Hypomyces aurantius*. The pileus is frequently overgrown by green algæ.

**P. abietinus** Cooke (1604).—P. greyish white, effuso-reflexed, dimidiate, sometimes resupinate, imbricate, villose, obsoletely zoned, margin sometimes purplish; T. violaceous, becoming pale, pores unequal, torn. Conifer trunks etc. C. 3 in. diam.

## LXIV. TRAMETES Fr.

(Latin *trama*, the woof—with reference to the internal substance of the dissepiments.)

The cap when present is woody to corky, dimidiate or resupinate, sessile; the tubes do not form a distinct layer; the pores are subrotund, more or less elongated radially, entire, often unequal in depth with somewhat thick dissepiments. There are about fifteen British species; almost universally growing on wood; sometimes imbricate. Annual or perennial.

**T. gibbosa** Fr. (1650).—P. whitish, becoming greyish, dimidiate, flattened, extended behind, gibbose, villose, subzonate, margin obtuse and often brownish; pores whitish, linear, straight, equal; flesh whitish, compact, thick, very firm, corky. Stumps and posts. F. 6 in. diam.

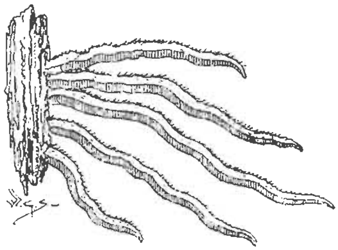

Fig. 68. Section of *Polystictus versicolor* Fr. (× ½.)

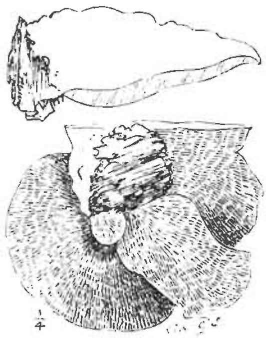

Fig. 69.—*Trametes gibbosa* Fr. (× ¼.)

**T. rubescens** Fr. (1650*a*).—P. whitish, becoming red, dimidiate, flattened, white-pruinose, then zoned, margin thin; pores white, becoming crimson-lake or blood-red when touched, pruinose, roundish, then elongate and dædaliform, narrow, obtuse; flesh white, becoming red when broken, corky, soft, zoned. Willow and alder trunks. F. $1\frac{3}{4} \times 1\frac{1}{4}$.

**T. suaveolens** Fr. (1652).—P. whitish, dimidiate, pulvinate, triquetrous, villose, margin thin and becoming yellowish; pores white, becoming yellowish or fuscous, round, rather large, obtuse; flesh white, soft, corky, thick; smell strong of anise. Willow trunks etc. F. $6\frac{3}{4}$ in. diam.

**T. mollis** Fr. (1655).—Yellowish or brownish white, at length becoming fuscous or black, resupinate, broadly effused, determinate, adnate behind in the centre, submembranous, margin umber, finally revolute and pubescent beneath; pores whitish cream, becoming greyish, large, shallow, angular or round, often irregular, unequal, torn; flesh white, soft, then coriaceous. Dead beech wood. C. $4\frac{1}{2}$ in. diam.

## LXV. DÆDALEA Pers.

(Greek *daidalos*, curiously wrought—from the appearance of the pores).

Fig. 70.—*Dædalea quercina* Pers. (× ¼.)

*Dædalea* agrees with *Trametes*, except in the firmer and sometimes thick dissepiments of the pores, which, when fully grown, are irregularly sinuous or labyrinthine, often becoming torn or toothed, the floccose substance of the cap descending unchanged into the trama.

D. quercina Pers. (1658).—P. buff-brown, darker behind, dimidiate, sessile, smooth, rugulose, uneven, marked with concentric raised or depressed zones, corky; pores somewhat paler, greyish or fuliginous, thick, long, woody, sinuate or lamellose, branched and anastomosing. Oak stumps etc. C. 7 in. diam.

## LXVI. MERULIUS Halle.

(Latin *merula*, a black-bird.)

The fruit-body is resupinate or effuso-reflexed, and usually gelatinous to waxy in consistency, but may be membranous or floccose; the hymenium is smooth at first, but becomes reticulated with irregular obtuse folds or pores, which are finally gyrose or obsoletely toothed. Growing on wood, rarely on the ground. There are about twenty British species.

133. **M. lacrymans** Schum. (1680). (Latin *lacrymans*, weeping—from the watery drops exuded during growth.)

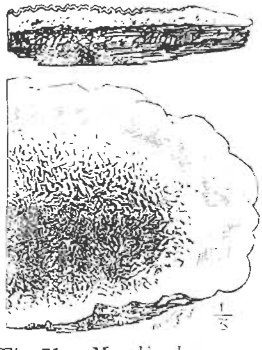

Fig. 71.—*Merulius lacrymans* Schum. (× ¼.)

Fruit-body broadly effused, usually entirely resupinate, but sometimes effuso-reflexed, more rarely arising from a stalk-like central tubercle, spongy-fleshy, arachnoid-velvety below; pores yellow-ferruginous, yellow towards the white, barren, tomentose margin, shallow, labyrinthine, gyroso-toothed, large; flesh greyish white, spongy fleshy, exuding drops of water when growing; spores reddish rust-colour in mass, yellow under the microscope; smell often strong, somewhat of fish.

On worked wood in buildings, logs in timber-yards, etc. Common. Jan. to Dec. 18 in. diam.

This fungus causes *the* "dry rot" of houses and has been known since biblical times ("Plague of leprosy in a house." Leviticus, xiv., verses 34–53). The general term "dry rot" is used by builders for a decay which arises in apparently sound wood after it has been used for constructional purposes, that of "wet rot" for decay which is apparent in the standing tree or in the unworked wood.

*Merulius lacrymans* is regarded by Falck as comprising four species, *M. domesticus*, *M. silvester*, *M. minor*, and *M. Sclerotiorum*. It remains to be seen whether these are to be considered as anything more than forms depending upon environmental conditions. *M. domesticus* is the common species met with in houses in this country and it is the one described above. It is rarely, if ever, found in woods, though *M. silvester* is not infrequent. It follows, therefore, that infection of the wood must take place in the timber-yard etc., or after it has been used for building. Two modes of infection are open, either by spores or by vegetative mycelium. The spores, though thin-walled, are long-lived and are able to germinate after several months—in fact, a proportion of spores have been found to retain their vitality after six years. Germination will take place in water, and in various neutral and acid solutions. Falck has shown that the spores germinate freely on wood previously attacked by certain other wood-destroying fungi, including *Coniophora puteana* (p. 148). According to Groom, "this incidental co-operation between the two species goes further and has important practical bearings. *Coniophora* demands for its growth in wood a large supply of moisture; hence if wood be protected against excess of moisture it is guarded against this fungus directly, and *Merulius lacrymans* indirectly. *Merulius lacrymans*, once established, can manufacture water and thereby moisten and attack the driest wood, and incidentally render the latter open to attack from *Coniophora*." Spores falling on the exposed end of a beam, a board, or such-like germinate and send out mycelia. These having once gained an entrance into the wood exhibit two different modes of growth. The first type consists of numerous fine hyphæ within the wood, feeding on it and destroying it. These hyphæ secrete enzymes (hadromase, cytase, emulsin, etc.), which enable them to absorb nutriment from the cell-walls, leaving behind a brown residue. So long as sufficient moisture is present the altered wood retains its original form, but as moisture is lost the wood becomes fissured with cracks at right angles to each other, and on rubbing or under pressure falls away into a brown powder. The second type of growth is superficial; numerous hyphæ run over the surface of the wood, weaving themselves into cord-like strands, into thin papery sheets, or mass into thick pads. This superficial mode of growth, which is related to a local shortage of water-supply, enables the fungus to spread over surfaces from which it is unable to obtain nutriment, such as brickwork, bell-wires, under tiles or mosaic work, even through mortar, and to attack other wood at a distance from the original source of attack. In this way an infection starting in a cellar may spread all through a house and into the bedrooms.

The fruit-body may appear on wood or on brickwork. When the fructification is on a horizontal support it is flat and not infrequently sterile when facing upwards; on vertical or oblique supports it assumes a bracket-shape. Apart from the characteristic fructification, identification of the fungus is best made from the mycelial cords or strands (similar cords occur in *Poria vaporaria*, p. 135, and *Coniophora puteana*, p. 148). These are roundish in section, and when fresh are pure white with a somewhat floccose surface, becoming grey to blackish with age. They vary in thickness from that of a thread to about a quarter of an inch, anastomosing frequently and often forming a loose network. When bearing fructifications they may attain a diameter of half an inch. Their structure is characteristic. They consist of three elements: (1) ordinary mycelial hyphæ, in no way different from those occurring elsewhere in the fungus, forming a ground-tissue; (2) water-conducting hyphæ, very wide and very long, with perforate cross-walls and infrequent branching which serve to transport nutritive substances in solution; and (3) strengthening hyphæ with very thick walls, which serve as mechanical tissue.

The general mycelium when growing in a confined space often becomes bright yellow in colour. The clamp-connections which occur in the aerial mycelium frequently send out a branch.

When the fungus is grown on a feeble nutrient medium gemmæ are formed. The protoplasm recedes from the ends of the segments, gathers towards the middle, and cuts itself off by new cell-walls. These gemmæ germinate and give rise to mycelia. Their occurrence is probably of great significance, as their presence in mycelium in old dried wood would account for the observation of Mez, who found living mycelium in infected wood kept dry for four and a half years. The highest temperature at which the usual domestic form of *Merulius lacrymans* will grow is 79° to 80° F., according to Falck, growth being most luxuriant at 71°. This accounts for the absence of the fungus from the tropics. The presence of the fungus in houses has frequently been said to be the cause of illness. The fact that the temperature of the human body (98·4°) is fatal to the mycelium and spores, after a short exposure, is sufficient to acquit the fungus of any suspicion.

*Control*.—As in the case of all disease the safest policy is that of prevention. From what has already been said, it suggests itself that previous to and during building operations timber should be guarded against contact with infected material; well-seasoned wood should be used and this should be protected from wet during building and afterwards by adequate ventilation. The lack of proper ventilation is the indirect cause of most dry rot in houses.

Various antiseptics have been advocated. For absolute safety against attack it is necessary thoroughly to impregnate the wood, but, as this is a costly and somewhat difficult operation, it is usual merely to coat wood with the antiseptic. The most effective substance is creosote, but its odour and colour render it unsatisfactory for use in dwelling-houses. Falck, working with over sixty possible preservatives, found that the most effective inorganic substance was magnesium fluosilicate, though boric acid has much to recommend it; amongst organic substances dinitro-phenates and dinitro-cresates of sodium and potassium proved the most effective, the best being the sodium salt of 2 : 4 dinitrophenol. Since the last-named washes out and dissolves it cannot be used out of doors; and as, moreover, it is explosive, it requires to be mixed with an inert substance.

Where the renovation of decayed structures is being carried out, all possible sources of re-infection should be removed. It is obvious that pieces of rotten wood pugging should not be left littered about, and wood that is already infected should be cut out. The walls should be flamed and the woodwork washed with a dilute solution of formalin or of corrosive sublimate; this serves to kill spores and mycelium. New wood should be treated with an antiseptic, particularly at the ends. Measures should be taken to open up ventilation and to prevent the wood becoming damp in any way.

*Merulius* will attack all kinds of wood, even the hardest teak. Wooden ships were in past times extensively destroyed by it. During the reign of Charles II. a commission was formed to inquire into the state of the navy, and Pepys, who was Secretary to the Admiralty, tells of thirty new ships that for the want of proper care and attention had toadstools growing in their holds as big as his fists, and were in so complete a state of decay that some of the planks had dropped from their places. A writer in the *European Magazine* for 1811 describes a ship attacked by dry rot at Woolwich, which was in so bad a state that the decks sank under a man's weight and the orange and brown coloured fungus was seen hanging in the shape of inverted cones from deck to deck.

**M. tremellosus** Schrad. (1667).—White, translucent, gelatinous, cartilaginous when dry, resupinate then reflexed, often connate and imbricate, tomentose, margin often pinkish, dentato-radiate; pores ruddy, pinkish, or pale, twisted, toothed. Stumps etc. F. 6 in. diam.

**M. corium** Fr. (1669).—Whitish, resupinate, effused, often imbricate, leathery, flexible, margin at length free and reflexed, villose beneath; pores flesh-colour or pale tan, small, reticulato-gyrose. Dead wood etc. C. 6 in. diam.

## LXVII. PORIA Pers.

(Greek *poros*, a pore.)

*Poria* resembles *Polyporus*, but the species are entirely resupinate, forming more or less extended patches or thin membranous expansions; the tubes are often directly inserted on the mycelium. There are about fifty British species, the majority of which grow on wood.

**P. ferruginosa** Karst. (*Fomes*) (1608).—P. ferruginous or cinnamon, effuso-reflexed, imbricate, often entirely resupinate, subtomentose, rough, margin sterile; T. cinnamon, stratose, pores ferruginous, round, torn. Logs etc. C. 6 in. diam.

**P. vulgaris** Fr. (1633).—White, sometimes yellowish, broadly effused, consisting almost entirely of the pores, thin, arid, closely adnate, minutely tomentose, margin smooth; pores white, glistening, somewhat shallow, very small, round, subequal, sometimes oblique. Dead wood etc. C. 5 in. diam.

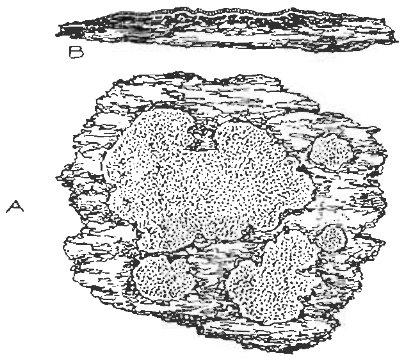


Fig. 72.—*Poria vaporaria* Cooke. A, entire; B, section. (× ½.)

**P. sanguinolenta** Cooke (1636).—Whitish, bleeding when touched, nodulose, soon confluent, effused, soft, margin flaxy, soon vanishing; pores white, blood-red when touched, subround, unequal, edge pubescent, pruinose, at length torn; smell strong. Dead wood etc. F. 3 in. diam.

**P. vaporaria** Cooke (1638).—White, effused, innate, inseparable; pores white, then cream, large, angular, toothed, forming a continuous, firm, persistent stratum. Dead branches and worked wood. C. 4 in. diam.

This fungus is an important cause of dry rot in houses. It may be distinguished from *Merulius lacrymans* (No. 133) by the fact that the mycelial cords remain white and that structurally they contain not only scanty vessel-like hyphæ but very abundant fibre-like ones, so that when old they are tough and not brittle. The clamp-connections on the mycelium are without branches.

## LXVIII. POROTHELIUM Fr.

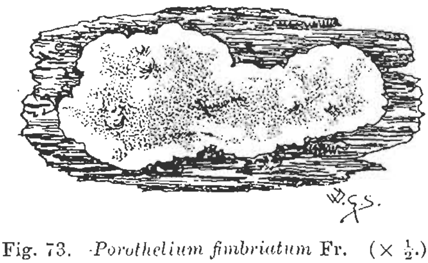

Fig. 73. *Porothelium fimbriatum* Fr. (× ½.)

(Greek *poros*, a pore, *thele*, a nipple—from the appearance of the papillæ.)

The subiculum is more or less membranous and bears obtuse or elongate papillæ, which are closed at first and then open in the form of pores or tubes. Growing on wood. There are three British species. The tubes often exude fluid in moist situations.

*Porothelium* shows certain resemblances to *Fistulina*, but is more closely allied to *Solenia* and *Cyphella.*

**P. fimbriatum** Fr. (1682).—Subiculum snow-white, effused, firm, separable, minutely tomentose, pruinose, attached to the matrix by a white cord-like mycelium, margin fringed and silky; pores white, papillate, then urceolate, bordered pink, pubescent. Stumps etc. O. 4 in. diam.

## Family 3.—HYDNACEÆ.

This family is characterised by the hymenium bearing persistent spines, teeth, tubercles, papillæ, or wart-like folds; the hymenium is inferior in the stipitate and dimidiate species, and superior in the resupinates.

*Key.*

| | |
|---|---|
| I. Fleshy or gelatinous; pileate or resupinate. | |
| 1. Hymenium spread over flattened irregular teeth; fleshy; pileate | *Sistotrema.* |
| 2. Hymenium covering awl-shaped spines | 3. |
| 3. Fleshy; pileate or resupinate; basidia continuous | *Hydnum.* |
| Gelatinous; pileate; basidia longitudinally quadriseptate. | *Tremellodon.* |
| II. Membranous, waxy, or coriaceous; resupinate. | |
| 4. Fruit-body reduced to long, slender, isolated spines arising directly on the mycelium | *Mucronella.* |
| 5. Subiculum present | 6. |
| 6. Hymenium of alveolar tubes, which become torn or toothed | *Irpex.* |
| Hymenium bearing irregularly scattered or confluent, obtuse, often deformed tubercles | *Radulum.* |
| Hymenium bearing radiate veins or wrinkles | *Phlebia.* |
| Hymenium covered with obtuse or pointed, entire tubercles or spines | *Grandinia.* |
| Hymenium covered with conical spines, ciliate or penicillate at the apex | *Odontia.* |
| Hymenium covered with very minute, acute, sterile spines. | *Kneiffia.* |

## LXIX. HYDNUM Linn.

(Greek *hydnon*, a truffle.)

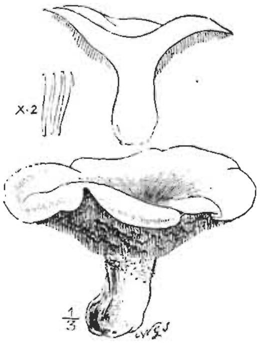


Fig. 74.—*Hydnum repandum* Linn. (× ⅓.)

The species are either stipitate or resupinate; the hymenium is inferior in the former and superior in the latter, and bears awl-shaped acute spines distinct at the base. There are about fifty British species. The genus has recently been much subdivided.

i. Stem central.

134. **H. imbricatum** Linn. (1687).
(Latin *imbricatus*, covered with tiles.)

Cap rich dark rufescent brown, convex, then plane, often subumbilicate, finally infundibuliform, floccose, tesselato-scaly; stem whitish or concolorous, short, firm, smooth; spines cinereous

white, decurrent, subulate, thin; flesh pale, then buffish or reddish; taste bitter.

Coniferous woods. Not uncommon. Sept. to Nov. $9 \times 2\frac{1}{2} \times \frac{1}{2}$. Edible.

**H. squamosum** Schaeff. (1688). P. rufous, fuscous, convex, gibbous, then irregular and depressed, smooth, breaking up into irregular, fibrillose, chestnut-coloured scales; S. white, attenuated downwards, smooth; spines greyish fuscous, with whitish apex, thin; flesh whitish; taste pleasant. Coniferous woods. R. $3 \times 19 \times \frac{3}{4}$. Edible.

**H. molle** Fr. (1690).—P. white, then greyish or chocolate-tinted, convex, then umbilicate or irregularly depressed, densely tomentose; S. white, then grey, conical, glabrous; spines white, then grey, decurrent, acuminate, thin, crowded; flesh white, becoming yellowish; taste pleasant. Coniferous woods. O. $4\frac{1}{2} \times 1\frac{3}{4} \times 1$. Edible.

**H. lævigatum** Swartz (1691). P. greyish umber, often with a fuscous-purple tinge at first, somewhat irregular, convex, then plane or depressed, smooth, then minutely squamulose, margin incurved and pubescent; S. greyish or lilac, often excentric; spines umber fuscous, apex whitish, decurrent, large; taste bitter; smell strong, unpleasant. Coniferous woods. R. $4\frac{1}{2} \times 1\frac{3}{4} \times 1$. Edible.

**H. fragile** Fr. (1692). P. pallid, soon cinereous or brick rufescent, convex, then plane and depressed, pubescent, becoming smooth towards the undulated and lobed margin, minutely squamulose or wrinkled; S. pallid, then rufescent or cinereous, often swollen at the base, unequal, smooth; spines whitish, then grey, scarcely decurrent, subulate, slender, fragile; flesh grey or reddish. Coniferous woods etc. R. $4\frac{1}{2} \times 2\frac{1}{2} \times 1$. Edible.

135. **H. repandum** Linn. (1694). (Latin *repandus*, bent backwards.)

Cap pale buff flesh-colour or subrufescent, convex, subrepand, often irregular and excentric, smooth, minutely floccose and pruinose, firm, margin often lobed; stem white or pallid, ochraceous at the base, irregular; spines white, then flesh-colour, decurrent, unequal, conical, entire, rarely bifid or tubular, brittle; flesh white; taste bitter; smell pleasant.

Woods. Common. Aug. to Nov. $5 \times 2 \times 1$. Edible.

**H. rufescens** Pers. (1695).—Differs from 1694 in being smaller and rufescent, and in the spines being adnato-decurrent. Woods. C. $3\frac{1}{2} \times 3 \times 1$. Edible.

**H. acre** Quél. (1696). (Latin *acris*, sharp.)

Cap light yellow, then olivaceous or bistre, plane, shaggy, velvety; stem cream olivaceous, oval, often branched, villose; spines white, then brown with light yellow apex, decurrent, thin; flesh light yellow, watery; taste bitter acrid.

Woods and sandy places. R. $5 \times 1\frac{1}{4} \times 1$. Poisonous.

ii. Stem lateral, somewhat dimidiate.

**H. auriscalpium** Linn. (1707).—P. pallid or flesh-colour, then date-brown or blackish, coriaceous, dimidiate, reniform, hispid-hairy, margin often lobed; S. ochraceous, then concolorous, vertical, usually lateral, hispid, rooting; spines yellowish or flesh-colour, then cinereous and brown, coriaceous, thin, crowded. Fir-cones. C. $1 \times 2 \times \frac{1}{16}$.

iii. Very much branched or tuberculiform.

**H. coralloides** Scop. (1708).—Wholly shining white, becoming faintly yellowish. P. very much branched, the narrow and intricate branches arising from a thick trunk; spines fasciculate, $\frac{1}{4}$ in. long, subulate, entire, unilateral. Decayed trunks. O. $12 \times 8$. Edible.

**H. erinaceus** Bull. (1709).—Wholly white, becoming pale yellowish. P. spathulate, pendulous, tubercular, immarginate, torn into fibrils above; S. sometimes rudimentary: spines up to $2\frac{1}{2}$ in. long, pendulous, straight, equal, simple, crowded, pruinose. Trunks. O. 13×13. Edible.

The conidial form, which apparently occurs earlier in the season, differs somewhat in colour, being first whitish, then a little ochraceous, and finally tinged salmon. The stem is usually much more developed and branched, the branches ending in five or six spines about $\frac{1}{4}$ in. long.

Causing a "white rot" of many deciduous trees, principally oaks.

iv. Sessile, dimidiate.

**H. cirrhatum** Pers. (1711). P. pallid, varying white, light yellowish, or rufescent, effused, then reflexed, dimidiate, conchate, often imbricate, upper surface bristling with sterile spines or scattered flexuose fibres, margin pink, incurved, and fimbriate; spines cream-colour, up to $\frac{1}{2}$ in. long, subulate, tough, elastic, equal, thin; flesh white, then pinkish cream-colour, corky, soft; taste and smell pleasant. Trunks. 6 in. diam. Edible.

**H. diversidens** Fr. (1712). Differs from 1711 in the frequently irregular shape, in the upper surface being densely covered with erect, variously shaped incised teeth, in the lobed membranous margin clothed with clavate "spines," in the pubescent spines, and the soft moist flesh. Stumps. R. 5 in. diam. Edible.

**H. ochraceum** Pers. (1715) (*Mycoleptodon*). White or pale ochraceous, rounded, then confluent, effused or effuso-reflexed and dimidiate, tomentose, sometimes narrowly grooved, zoned, margin white, membranous, subfimbriate and pubescent; spines ochraceous flesh-colour, subulate, very small, hispid at the apex, shorter at the margin; flesh whitish, thin, coriaceous. Dead branches. C. 5 in. diam.

v. Resupinate: hymenium covering the free surface.

**H. crinale** Fr. (1721) (*H. ferrugineum* Fr., 1722. *Caldesiella*).—Tawny ferruginous, effused, separable, tomentose; spines concolorous, subulate, conical, acute, straight, or oblique, often subcompressed, tomentose, crowded; flesh floccose. Decayed wood under bark. F. 3 in. diam.

**H. udum** Fr. (1737) (*Acia*). Bright sulphur, lemon-yellow, flesh-colour, or olivaceous, becoming watery yellowish, widely effused, adnate, smooth, margin lemon-yellow, pruinose, or fibrillose; spines concolorous or yellowish flesh-colour, becoming tawny, subulate, thin, entire, or toothed: flesh yellowish white near the matrix, waxy, soft, subgelatinous; smell pleasant. Dead branches. C. 5 in. diam.

## LXX. TREMELLODON Fr.

(From its resemblance to *Tremella*—Greek *odous*, a tooth.)

The receptacle is gelatinous and soft; the hymenium is inferior, covering acute awl-shaped spines; the basidia are globose and longitudinally cruciately septate. The single British species grows on wood.

*Tremellodon* is usually placed in the Tremellinaceæ on account of the character of its basidium.

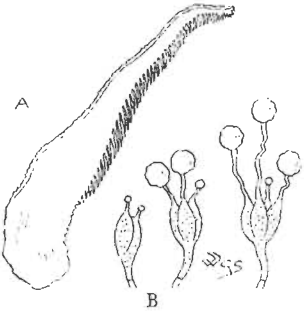


Fig. 75.- A, section of *Tremellodon gelatinosum* Fr., × $\frac{1}{2}$; B, basidia, × 500.

**T. gelatinosum** Fr. (1746).—Rc. glaucous-fuscous or tawny brownish, dimidiate, spathulate, or fan-shaded, sessile or substipitate, surface papillose; spines white or glaucous, conical, straight, gelatinous; flesh hyaline, gelatinous, transparent, thick. Coniferous stumps and sawdust. F. $3\frac{1}{2}$×$3\frac{1}{2}$. Edible.

## LXXI. SISTOTREMA Fr.

(Greek *seistos*, shaking, *trema*, a pore—from the irregular arrangement of the pores and their interstices.)

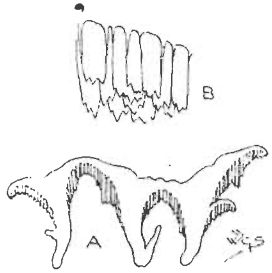


Fig. 76. -A, section of *Sistotrema confluens* Pers., × ½; B. teeth, × 3.

The cap is fleshy; the stem is central, lateral, or absent; the tubes become broken up into teeth or plates anastomosing at the base. The species grow on the ground or on wood. There are two British species.

**S. confluens** Fr. (1747).- P. white, then yellowish, hemispherical, spathulate, or irregular, horizontal, villous, margin flexuose and often yellowish; S. white or ochraceous, central or lateral, often connate, attenuated downwards, pruinose; T. concolorous, flexuose, entire or toothed, pruinose. Coniferous woods. F. 2¾×1½.

## LXXII. IRPEX Fr.

(Latin *irpex*, a harrow—from the teeth.)

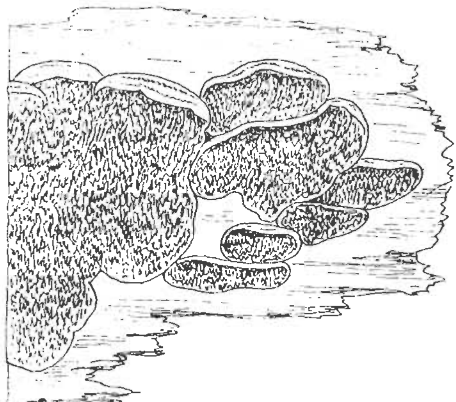

Fig. 77. *Irpex fuscoviolaceus* Fr.

The fruit-body is corky, coriaceous, or membranous, dimidiate or resupinate, and sessile; the tubes are homogeneous, alveolar at first, then torn into teeth or plates. Growing usually on wood. There are about ten British species.

*Irpex* is most closely allied to *Dædalea* and *Trametes*.

**I. obliquus** Fr. (1754).—Re. white, then yellowish or wood-colour, broadly effused, adnate, margin byssoid; teeth concolorous, at first pore-like, then compressed, incised, or torn, oblique, lamellar at the base. *Stumps, branches, etc.* C. *5 in. diam.*

## LXXIII. RADULUM Fr.

(Latin *radix*, a root--from the root-like appearance of the processes of the hymenium.)

The receptacle is resupinate, effused and waxy, or somewhat coriaceous: the tubercles are distinct at the base, thick, irregular in shape, commonly elongate, obtuse, mostly scattered, or fasciculate and tooth-like. Growing on wood. There are about seven British species.

Fig. 78.—*Radulum quercinum* Fr. (× ½.)

**R. orbiculare** Fr. (1758).—White, then yellowish, orbicular, confluent, margin white, byssoid, and membranous; tubercles concolorous or dingy flesh-colour, scattered or fasciculate, mere granules near the barren margin. Dead bark of trees. C. 2½ in. diam. Group 4½.

**R. quercinum** Fr. (1759).—White, then pallid or tan-colour, roundish, then broadly confluent, adnate, often throwing back the bark, margin white, and floccoso-villose; tubercles concolorous, cylindrical, obtuse, pointed or toothed, scattered or fasciculate, often villose at the apex. Fallen oak branches and worked wood. C. 3½ in. diam.

**R. deglubens** B. & Br. (1761) (*Eichleriella*).—Flesh-colour, then wood-brown, longitudinally and broadly effused, confluent, separable, margin white, free or reflexed, tomentose beneath; hymenium concolorous, pruinose, becoming red when rubbed, usually bearing distant, simple, or multifid tubercles; flesh coriaceous, thick; basidia longitudinally cruciately septate. Dead branches of ash and poplar. O. ½ in. diam. Group 5 in.

## LXXIV. PHLEBIA Fr.

(Greek *phlebs*, a vein—from the appearance of the hymenium.)

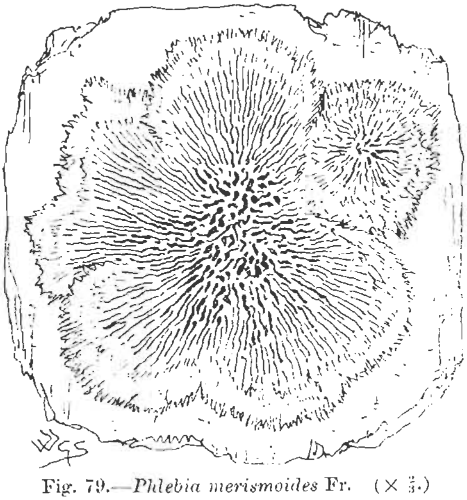

Fig. 79.—*Phlebia merismoides* Fr. (× ¾.)

The receptacle is waxy or subgelatinous, becoming cartilaginous when dry, and is erect or resupinate and effused; the hymenium from the first covers radiating, obtuse, persistent wrinkles or veins, which are continuous or interrupted to form tubercles. Growing usually on wood. There are about six British species.

*Phlebia* is closely related to *Merulius*.

**P. merismoides** Fr. (1765).—Flesh-colour, then livid, widely effused, smooth or uneven, villose and white beneath, margin orange and strigose; veins purplish flesh-colour, simple, straight, or tubercular, crowded. Stumps, logs, etc. C. 4 in. diam.

**P. radiata** Fr. (1766).—Red flesh-colour or vermilion-orange, roundish, often confluent, equal, smooth on both sides, margin radiately toothed; veins purplish flesh-colour, straight, radiating in rows. Dead wood etc., especially of alder. C. 2 in. diam. Group 5½.

When in good condition forming conjoined, more or less hexagonal growths resembling the carapace of a tortoise.

## LXXV. GRANDINIA Fr.

(Latin *grando*, hail—from the granular appearance of the hymenium.)

The fruit-body is resupinate, effused, membranous or crustaceous with small, persistent, hemispherical, obtuse or subulate, entire, crowded tubercles. Growing on wood. There are about five British species.

**G. mucida** Fr. (1771).—Pale yellowish, effused, subinnate, corrugated or cracked when dry, margin indeterminate, somewhat radiating; granules concolorous, hemispherical, large, unequal, crowded, soft: flesh yellowish, waxy, subgelatinous. Rotting bark, pine, etc. F. 4 in. diam.

## LXXVI. ODONTIA Pers.

(Greek *odous, odontos*, a tooth—from the minute teeth on the hymenium.)

The fruit-body is resupinate, effused, crustaceous or pruinose with conical, multifid, penicillate, or ciliate spines. Growing on wood. There are about twenty British species.

**O. barba-Jovis** Fr. (1775). White, then yellowish, slightly adnate, floccose, margin narrow, byssoid and pubescent; spines concolorous, subulate, with one or many very thin points, more or less bristly on the sides, sometimes with an orange fringe at the apex. Wood and branches. F. 6 in. diam.

[**HYDNOPSIS** Rea resembles *Odontia*, but has coloured spores.

**H. farinacea** Rea.—White, effused, adnate; spines white, then wood-colour, and finally umber, subulate, acute, subdistant. Dead beech leaves etc. O. 2 in. diam.

**PROTODONTIA** von Hoehn.—Differs from *Odontia* in having subgelatinous teeth and vertically septate basidia.

**P. uda** von Hoehn. Pure white and slightly hyaline when fresh, yellowish when dry; spines hyaline, then yellowish and collapsing, slender. Rotten wood. R. 1 in. diam.]

## LXXVII. KNEIFFIA Fr.

(After F. G. Kneiff, a German mycologist.)

The fruit-body is subgelatinous and effused with minute scattered and sterile spines or granules. Growing on wood. One British species.

**K. subgelatinosa** B. & Br. (1779). Yellowish, then cream-colour, broadly effused; granules concolorous, subgelatinous, fringed at the apex. Fir stumps etc. R. 4 in. diam.

## LXXVIII. MUCRONELLA Fr.

(Latin *mucronella*, a small sharp point.)

In *Mucronella* the subiculum is absent or indefinite, and formed of floccose fugacious mycelium; the spines are simple, cylindrical, subulate, acute, scattered or fasciculate, and more or less connate at the base. Growing on wood. There are two British species.

**M. calva** Fr. (1780).—Spines white, then pale, scattered, rigid, slender, smooth, varying in size from a minute granule to an inch in length. Rotten pine stumps. R.

## Family 4.—THELEPHORACEÆ.

The genera of the Thelephoraceæ agree in having a well-defined hymenium, which is either quite smooth or slightly rugose. The sporophores may be erect and stipitate, cup-shaped, effused with the upper portion free, or resupinate; the substance leathery, waxy, or gelatinous. Recent investigations have shown that both the family, as a whole, and the individual genera are somewhat heterogeneous. Most species require microscopic examination for certainty of determination.

### *Key.*

| | |
|---|---|
| I. Erect, horizontal, or effuso-reflexed; leathery to woody. | |
| 1. Funnel-shaped or umbilicate, hymenium veined or smooth | *Craterellus.* |
| Horizontal and attached by a narrow portion behind; hymenium with folds or veins ........ | *Cladoderris.* |
| Effuso-reflexed to erect, simple, or branched ........ | 2. |
| 2. Hymenium smooth; flesh pale; spores white ........ | *Stereum.* |
| Hymenium setulose with coloured setæ; flesh coloured; spores coloured ........ | *Hymenochæte.* |
| Hymenium smooth, granular, or faintly ribbed; flesh coloured; spores coloured ........ | *Thelephora.* |
| II. Effused or resupinate; waxy, crustaceous, or floccose. | |
| 3. Parasitic on leaves and stems of Ericaceæ; effused ........ | *Exobasidium.* |
| Usually lignicolous; resupinate ........ | 4. |
| 4. Hymenium smooth, often cracked; spores white ........ | *Corticium.* |
| Hymenium granular or smooth; spores coloured ........ | *Coniophora.* |
| Hymenium setulose with projecting cystidia; spores white | *Peniophora.* |
| III. Cup-shaped, waxy to leathery. | |
| 5. Cups scattered, mouth expanded ........ | *Cyphella.* |
| Cups crowded, mouth closed, seated on a felt-like, then floccose and fugacious mycelium ........ | *Solenia.* |

## LXXIX. **CRATERELLUS** Pers.

(Greek, *krater*, a large bowl.)

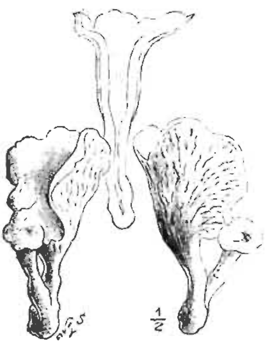

Fig. 80. *Craterellus lutescens* Fr. (× ½.)

*Craterellus* is allied to *Cantharellus*. The cap is fleshy or membranous, funnel-shaped or umbilicate, stipitate; the hymenium is distinct but adnate to the hymenophore, inferior, smooth, becoming rugulose; the spores are usually white. Growing on the ground. There are about six British species.

136. **C. crispus** Fr. (1784). (Latin *crispus*, curled.)

Cap fuliginous, becoming fuscous, fleshy membranous, infundibuliform, subpervious, lobed, pruinose; stem yellow, becoming greyish, pruinose; hymenium pallid, even; odour strong of musk.

Woods. Frequent. Aug. to Nov. $2\frac{1}{2} \times 2 \times \frac{1}{4}$. Edible.

**C. cornucopioides** Fr. (1782).—P. blackish fuliginous when moist, brownish when dry, submembranous, tubæform, pervious, squamulose; S. black, dilated upwards into the P.: hymenium cinereous, even, at length wrinkled. Woods. C. $3\frac{1}{2} \times 5 \times \frac{1}{4}$. Edible.

Sold formerly in Covent Garden.

**C. lutescens** Fr. (1781) (*Cantharellus*). P. fuscous, submembranous, tubæform, soon pervious, undulate, flocculose: S. golden-yellow, attenuated at the base, undulate: G. yellow, inclining to reddish or orange, fold-like, thin, flexuose, anastomosing; odour strong, like spirit. Mountainous fir woods. O. $3 \times 4 \times \frac{3}{8}$. Edible.

**C. clavatus** Fr. (1785) (*Neurophyllum*).—P. lilac or rose, then flesh-colour, and finally ochraceous, fleshy, turbinate, truncate or depressed, flexuose, attenuated into the solid S.; S. whitish lilac or amethyst, then pale, obconic; hymenium purplish, then concolorous, fold-like, thick, anastomosing, reticulated, decurrent; spores ochraceous; smell and taste pleasant. Woods. R. $6 \times 3 \times \frac{1}{2}$. Edible.

## LXXX. THELEPHORA Ehrh.

(Greek *thele*, a teat, *phero*, to bear—from the sometimes papillose hymenium.)

The fruit-body is fibrous or coriaceous, varied in form, being pileate, clavate, or resupinate and destitute of a cuticle; the hymenium is inferior or amphigenous, continuous with and similar to the hymenophore, even, rugulose or ribbed, the ribs sometimes more or less papillose. Growing on wood or on the ground. The genus as here defined includes about twenty British species, but the resupinate forms are now placed in other genera.

137. **T. Sowerbei** Berk. (1786) (*Stereum*). (After James Sowerby, botanical artist, who made the collection of fungus models.)

Snow-white, becoming yellow; cap infundibuliform, flabelliform, or spathulate, uneven, margin incised, often crenate; stem gradually expanding into the cap, smooth or wrinkled, often confluent; hymenium smooth or wrinkled; flesh yellowish, thin; spores white.

On the ground amongst moss and under pine bark. Uncommon. Sept. to Nov. $2 \times 2\frac{3}{4}$.

138. **T. laciniata** Pers. (1797) (*T. terrestris* Pers., 1796). (Latin *laciniatus*, fringed.)

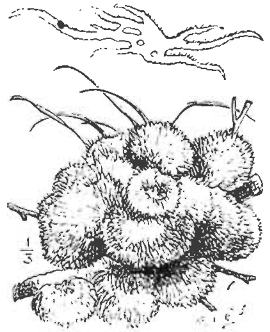

Fig. 81.—*Thelephora laciniata* Pers. ($\times \frac{1}{3}$.)

Fruit-body ferruginous-fuscous or fuscous, often becoming black with age, dimidiate, sessile or effuso-reflexed, confluent laterally, often imbricate, fibrillosely scaly, strigose, margin fimbriate and laciniate, often with a narrow white edge; hymenium fuscous or pale fawn, inferior, papillose: flesh concolorous; spores fuscous.

Woods and heaths. Common. July to Dec. $2\frac{3}{4}$ in. diam.

The fungus at first forms a resupinate yellowish or pinkish-brown film. The base of the mature fungus often incrusts branches as a thick membrane simulating a stem.

**T. cristata** Fr. (1800) (*T. fastidiosa* Fr. (1801), *Cristella*).—Chalky-white, becoming yellowish, widely effused, incrusting, irregular in shape, often forming flattened. confluent. lobed, or subulate branches with fringed or laciniate apices; hymenium concolorous, papillose, granular or reticulately veined; flesh fibrillosely floccose; spores white: smell unpleasant. On the ground, incrusting twigs, leaves, etc. O. 5½ in. diam.

**T. sebacea** Pers. (1802) (*Sebacina incrustans* Tul.).—Whitish, effused, incrusting, irregular in shape, tubercular, or as of melting and running tallow, apices somewhat subulate or fringed; hymenium whitish, even, flocooso-pruinose; flesh whitish. waxy, then leathery: basidia longitudinally cruciately divided. Incrusting grass. twigs, mosses. etc. C. 5 in. high.

**T. cæsia** Pers. (1804) (*Hypochnus*). -Cinereous, bluish-grey, or brownish-bistre, effused, suborbicular, determinate, tomentose; hymenium concolorous, becoming paler. even. minutely pubescent; flesh brownish; mature spores brownish, verrucose. Wood etc.. and on the ground. F. 3½ in. diam.

[**HYPOCHNELLA** Schroet. -Differs from *Hypochnus* in the violet smooth spores.

**H. violaceus** Schroet.—Rich lilac, becoming darker and duller when dry. irregularly effused; hymenium concolorous, smooth; flesh bluish, very thin, floccose, lax. Underside of fallen branches. O. 4 in. diam.

**JAAPIA** Bres.– Resembles a pale *Hypochnus*; spores straw-coloured, with a small hyaline cell cut off from each end.

**J. argillacea** Bres. - Clay-coloured, irregularly effused, flocculose, sometimes with scattered granules; hymenium concolorous, lax, then more continuous; flesh concolorous. very thin, floccose. Fallen sticks. R. ½ in. diam.]

## LXXXI. CLADODERRIS Fr.

(Greek *klados*, a branch, *derris*, a leathern covering.)

The fruit-body is coriaceous and pileate, sessile or extended behind into a stem-like base; the hymenium is inferior, radiate, or rugulose with branched ribs or narrow, much ramified folds. Growing on wood. One British species.

Fig. 82.—*Cladoderris minima* B. & Br. (A. nat. size; B. ×2.)

**C. minima** B. & Br. (1805).—Re. white, flabelliform. resupinate. springing from a stem-like or obsolete base. tomentose, subzonate: hymenium white, becoming yellowish, torn. radiate on branched ribs. Birch. R. $\frac{3}{16}$ in. diam.

Resembling a dwarfed *Stereum hirsutum*.

**T. cristata** Fr. (1800) (*T. fastidiosa* Fr. (1801), *Cristella*).—Chalky-white, becoming yellowish, widely effused, incrusting, irregular in shape, often forming flattened, confluent, lobed, or subulate branches with fringed or laciniate apices; hymenium concolorous, papillose, granular or reticulately veined; flesh fibrillosely floccose; spores white; smell unpleasant. On the ground, incrusting twigs, leaves, etc. O. 5½ in. diam.

**T. sebacea** Pers. (1802) (*Sebacina incrustans* Tul.).—Whitish, effused, incrusting, irregular in shape, tubercular, or as of melting and running tallow, apices somewhat subulate or fringed; hymenium whitish, even, floccoso-pruinose; flesh whitish, waxy, then leathery; basidia longitudinally cruciately divided. Incrusting grass, twigs, mosses, etc. C. 5 in. high.

**T. cæsia** Pers. (1804) (*Hypochnus*).—Cinereous, bluish-grey, or brownish-bistre, effused, suborbicular, determinate, tomentose; hymenium concolorous, becoming paler, even, minutely pubescent; flesh brownish; mature spores brownish, verrucose. Wood etc., and on the ground. F. 3½ in. diam.

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**H. violaceus** Schroet.—Rich lilac, becoming darker and duller when dry, irregularly effused; hymenium concolorous, smooth; flesh bluish, very thin, floccose, lax. Underside of fallen branches. O. 4 in. diam.

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**J. argillacea** Bres.—Clay-coloured, irregularly effused, flocculose, sometimes with scattered granules; hymenium concolorous, lax, then more continuous; flesh concolorous, very thin, floccose. Fallen sticks. R. ½ in. diam.]

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The fruit-body is coriaceous and pileate, sessile or extended behind into a stem-like base; the hymenium is inferior, radiate, or rugulose with branched ribs or narrow, much ramified folds. Growing on wood. One British species.

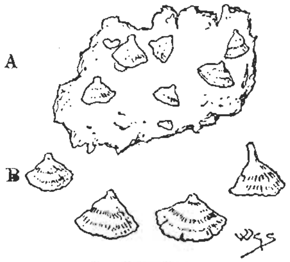


Fig. 82.—*Cladoderris minima* B. & Br. (A. nat. size; B, ×2.)

**C. minima** B. & Br. (1805).—Re. white, flabelliform, resupinate, springing from a stem-like or obsolete base, tomentose, subzonate: hymenium white, becoming yellowish, torn, radiate on branched ribs. Birch. R. $\frac{3}{16}$ in. diam.

Resembling a dwarfed *Stereum hirsutum*.

## LXXXII. STEREUM Pers.

(Greek *stereos*, hard.)

The fruit-body is effused or effuso-reflexed: the hymenium is inferior, smooth and even, and the upper surface velvety or strigose; the substance is coriaceous or woody. Growing on wood. There are about fifteen British species.

139. **S. hirsutum** Pers. (1806). (Latin *hirsutus*, hairy.)

Fruit-body pallid, yellowish, or greyish, with yellow margin, widely effused, then reflexed, strigosely hairy, subzoned, margin obtuse; hymenium bright ochraceous, pinkish, or tan-colour, sometimes becoming grey, even, smooth; flesh yellowish, leathery.

On stumps, logs, palings, etc. Common. Jan. to Dec. 4 in. diam.

When growing horizontally on fallen logs the young fructification often simulates a Discomycete.

*Hypomyces rosellus* often stains the fungus red.

**S. purpureum** Pers. (1808).—Re. whitish, pallid, or greyish, effuso-reflexed, subimbricate, zoned, villoso-tomentose; hymenium lilac or purplish, becoming dingy ochre when dry, even, smooth. Dead branches and logs of deciduous trees. C. 3½ in. diam.

This fungus has been shown by Brooks to be the cause of "silver leaf" of plums, apples, and other Rosaceous trees. The leaf shows a silvery or leaden sheen, owing to the epidermal cells breaking away and leaving an air-space, thus causing refraction of light. The affected branch dies back after a time, and as branch after branch becomes attacked the tree succumbs. The fungus does not enter the leaves, but is confined to dark brown or blackish areas in the wood. After the death of the branch the fruit-bodies of the fungus appear on the surface. Victoria Plum is particularly susceptible to attack.

Fig. 83. *Stereum hirsutum* Pers. (Nat. size.)

**S. sanguinolentum** Fr. (1809).—Re. pallid, white at the thin acute margin, effused, then reflexed, adpressedly villose or silky, substriate: hymenium cinereous, then fuscous, bleeding when touched, becoming cracked when dry. Stumps and branches, especially conifers. C. 3½ in. diam.

**S. spadiceum** Fr. (1811). Differs from 1809 in the pale yellowish or orange-brownish Re. with obtuse margin and the fuscous or bistre, then snuff-brown hymenium. Stumps and branches, especially oak and ash. C. 5 in. diam.

**S. rugosum** Fr. (1812). Differs from 1809 in the pinkish buff Re., paler behind, obtusely marginate, silky, then glabrous, and finally concentrically furrowed, and in the pinkish-buff to drab-grey hymenium. Stumps and branches of deciduous trees. C. 6 in. diam.

## LXXXIII. HYMENOCHÆTE Lév.

(Greek *humen*, a membrane, *chaite*, a bristle—from the bristly hymenium.)

The cap is coriaceous, firm, sessile, effuso-reflexed, or resupinate; the hymenium is inferior, plane to papillose, velvety, with minute, rigid, persistent, coloured setæ, three or four times the length of the basidia. Growing on wood, perennial. There are about twelve British species.

140. **H. tabacina** Lév. (1827). (Latin *tabacinā*, tobacco-colour.)

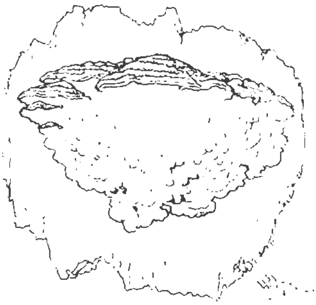

Fig. 84.—*Hymenochæte rubiginosa*, Lév. (× ½.)

Cap subferruginous, becoming brown, margin golden, coriaceous, flaccid, then silky, at length smooth, effused, reflexed, often imbricate, sometimes entirely resupinate; hymenium paler, snuff-brown or sepia, setulose, when resupinate often with deep radial anastomosing cracks; flesh golden.

Trunks, stumps, branches, etc. Not uncommon. 3½ in. diam.

**H. rubiginosa** Lév. (1819).—P. rubiginous or brownish rust-colour, margin ochraceous tawny, velvety, becoming smooth and date-brown effused, reflexed, sometimes resupinate, concentrically sulcate; *hymenium* ferruginous or bistre. Stumps etc. C. 6 in. diam.

## LXXXIV. CORTICIUM Pers.

(Latin *cortex*, bark.)

The fruit-body forms a closely adherent thin layer, which is sometimes slightly upraised at the margin; the texture is waxy, crustaceous, or floccose; the hymenium is smooth or tubercular, often becoming cracked when dry; the spores are colourless. Growing usually on wood. There are about forty British species.

The subgenus *Glœocystidium* possesses glœocystidia, which resemble the cystidia of *Peniophora*, but have thin walls, not encrusted with crystals.

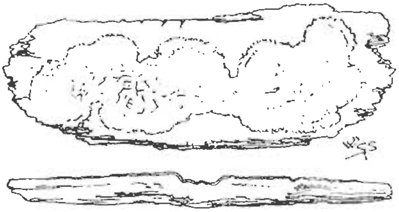

Fig. 85.—*Corticium calceum* Fr. (× ½.)

**C. læve** Pers. (1843) (*C. evolvens* Fr., 1834). White, cream-colour, flesh-colour, or tan, effused, wholly adnate, or forming distinct, reflexed, strigose pileoli, margin white, silky, radiating or becoming obtuse, reflexed; hymenium cream, then pinkish ochre, livid to brownish when old, pale buff tinged pink or lilac when dry, smooth, waxy, somewhat undulate, sometimes coarsely tuberculate, usually areolately cracked when dry; flesh pale, floccose, loose. Trunks etc. C. 8 in. diam.

**C. confluens** Fr. (1844).—Whitish, effused, indeterminate, agglutinate, margin white and mealy; hymenium hyaline, white when dry, smooth; flesh whitish, submembranous, thin, loose. Stumps etc. 3 in. diam.

**C. Sambuci** Pers. (1849) (*C. serum* Fr., 1839).—Snow-white or chalk-white, becomining yellowish when dry, effused, subinnate, incrusting, chalky, collapsing and more or less powdery when dry; hymenium concolorous, granular, pruinose; flesh white, crustaceous, very thin. Stumps etc. C. 8 in. diam.

**C. cæruleum** Fr. (1861). Azure-blue to indigo-blue, subrotund, broadly effused, adnate, at first tomentose, margin whitish or bluish, byssoid; hymenium concolorous, paler when dry, papillose; flesh bluish under the hymenium, waxy, floccose, loose. Wood etc. C. 6 in. diam.

Said to be luminous.

**C. lactescens** Berk. (1850) (*Glœocystidium*).—Whitish or flesh-colour, widely effused, agglutinate, margin white, byssoid, and pubescent; hymenium white to clear flesh-colour or pale brown-pink, smooth, pruinose; flesh pale, waxy, exuding a cloudy fluid when broken. Trunks and branches. F. 6 in. diam.

**C. salicinum** Fr. (1832) (*Cytidia*).—Blood-red, transparent, cup-shaped, then expanded or confluent, adfixed by the centre, white villose or delicately zoned on the outside; hymenium blood-red or orange, even, naked, zoned; flesh gelatinous, then horny, thin. Willow, rarely poplar. R. 4 in. diam.

**C. amorphum** Fr. (1833) (*Aleurodiscus*).—White, becoming pallid, cup-shaped, then flattened, scattered or confluent, externally white tomentose, the hairs incrusted with crystals, margin free and incurved; hymenium orange or buff-pink, becoming paler especially at the margin, subolivaceous when dry, even, continuous, pulverulent; flesh pale, subcoriaceous, pliant, dense. Conifers. O. $\frac{3}{4}$ in. diam.

**C. Typhæ** Fuckel (1848) (*Epithele*).—White, becoming yellowish or tan, longitudinally effused, originating as byssoid spots, then confluent; hymenium concolorous, smooth, then papillose, often cracked; flesh whitish, waxy, floccose, very thin. Dry leaves of *Typha* and *Carex*. O. 1½ in. diam.

**C. violeum** W. G. Sm. (1850 *b*) (*Tulasnella*).—Lilac-violet or rosy violet, becoming rosy, greyish when dry, broadly effused, margin brighter coloured and byssoid; hymenium concolorous, membranous, tomentose; flesh membranous, *very thin; basidia with very thick, stout sterigmata.* Dead wood. O. 4 in. diam.

[**HELICOBASIDIUM** Pat.—Resembles a membranaceous *Corticium*, but has more or less curved, transversely septate basidia, with subulate unilateral sterigmata.

**H. purpureum** Pat.—Dingy reddish purple, margin paler, broadly effused, adnate: *hymenium concolorous, then deep vinous and white pruinose; flesh* whitish, floccose, loose, thin. Leaf débris etc. R. 2½ in. diam.

**PLATYGLŒA** Schroet.—Similarly has transversely septate basidia, but the sterigmata are long; substance waxy or gelatinous.

**P. effusa** Schroet.—Greyish, whitish when dry, effused, closely adherent; hymenium pulverulent under a lens. Fallen branches. R. 2 in. diam.]

## LXXXV. PENIOPHORA Cooke.

(Greek *penion*, a shuttle, *phero*, to bear—from the projecting cystidia.)

*Peniophora* differs from *Corticium* in the presence of prominent hyaline cystidia, which are generally thick-walled or covered with crystals. The cystidia give the hymenium a velvety appearance. Growing principally on wood. There are about thirty British species.

**P. quercina** Cooke (1867).—Flesh-colour or orange, then lilac or greyish, finally slate-colour, effused, then cup-shaped and free, smooth and becoming black beneath, margin free and revolute; flesh pale or brownish, leathery, thick firm. Oak branches etc. C. 7 in. diam.

**P. gigantea** Mass. (1869). Hyaline, white, very broadly effused, swelling when moist, cartilaginous when dry, margin white, fibrillose, radiating, at length free; hymenium concolorous, often tinged brownish or lilac when old, smooth, minutely velvety; flesh whitish, waxy, then horny and parchment-like, thick, tough. Pine stumps etc. C. 8 in. diam.

**P. incarnata** Mass. (1873).—Reddish or orange, effused, agglutinate, adnate, margin white, narrow, byssoid, radiating, fugacious, often wanting; hymenium concolorous, pruinose, sometimes undulate, papillose, cracking when dry; flesh slightly coloured, waxy, then rigid, firm. Wood etc. C. 5 in. diam.

**P. cinerea** Cooke (1875).—Cinereous or lurid, effused, confluent, agglutinate, very adnate; hymenium concolorous, minutely pruinose; flesh brownish, waxy, then rigid, firm, compact. Wood etc. C. 6 in. diam.

**P. velutina** Cooke (1876) (*P. scotica* Mass., 1878). White or whitish, broadly effused, adnate, margin white or flesh-colour, running out into long branching strands: hymenium concolorous, becoming flesh-colour or reddish when dry, minutely velvety; flesh concolorous, soft, loose, fairly thick. Wood etc. C. 6 in. diam.

**P. hydnoides** Cooke & Mass. (1882).—Whitish or greyish, broadly effused, subinnate, indeterminate, very adnate, waxy, hyaline; hymenium grey, often becoming somewhat cream-colour, setulose, at length cracked; flesh thin, filamentous. Bark etc. C. 5 in. diam.

## LXXXVI. CONIOPHORA DC.

(Greek *konis*, dust, *phoreo*, to carry.)

*Coniophora* resembles *Corticium*, but differs in the coloured spores; the hymenium is smooth, tubercular or granular and powdered with the spores at maturity. Growing on wood or on the ground. There are about twelve British species.

**C. puteana** Karst. (1885) (*C. cerebella* Pers.).—Light yellowish pallid, finally fuscous olivaceous, broadly effused, roundish, separable, margin white and mucedinous; hymenium fuscous olivaceous, even, subundulate, or gyrose, often subtubercular, pulverulent; flesh whitish, membranous, rather thick. Bark, wood, etc., and worked wood particularly in damp cellars. C. 6 in. diam.

This is one of the principal fungi causing dry rot in buildings. It requires considerable moisture for its development, and apparently is particularly dangerous in the way in which it prepares the way for *Merulius lacrymans*. It is distinguishable from the latter when not fruiting by the fact that the clamp-connections in the mycelium form very characteristic rosettes with branches between, and by the abundant mycelial cords soon becoming brown and finally blackish.

**C. umbrina** Karst. (1887) (*Coniophorella*).—Umber, effused, not easily separable, villose beneath, margin narrow and radiating; hymenium concolorous or ferruginous, even, sometimes granular, setulose; flesh brownish, soft, loose, fairly thick. Wood etc. F. 6 in. diam.

**C. gelatinosa** W. G. Sm. (1897) (*Aldridgea*).—Pallid, broadly effused, margin determinate; hymenium purple-brown, smooth, even; flesh subgelatinous, then cartilaginous, becoming collapsed and rigid when dry. Sawdust. R. 5 in. diam.

## LXXXVII. EXOBASIDIUM Woron.

Fig. 86.—*Exobasidium Vaccinii* Woron. (× ½.)

(Latin *ex*, out of—from the structure, the basidia and spores being the most obvious parts of the fungus.)

The members of this genus vegetate within the leaves and stems of flowering plants (principally Ericaceæ), which they deform and hypertrophy. The basidia are borne on the exterior, and form a discontinuous hymenium; they usually bear four spores, but the number varies from one to six. The spores are simple, but become three-septate on germination. There are two British species.

**E. Vaccinii** Woron. (1899).—Greyish, innate, effused, usually orbicular or elongate, often confluent, forming a scurfy or felty hymenium, usually on the under surface of leaves and round stems, red or purple patches occurring on the upper leaf-surface opposite the infection. Various Ericaceæ. C. ½ in. diam.

## LXXXVIII. CYPHELLA Fr.

(Greek *kuphella*, the hollow of the ear.)

The fruit-bodies are cup-shaped or urceolate, waxy, membranous or subgelatinous, and stipitate or pendulous; the hymenium is smooth, rugulose, or veined. Growing on wood, twigs, mosses, etc. There are about twenty-five British species. Many species much resemble Discomycetes, but can immediately be distinguished on microscopical examination.

i. Spores white.

**C. capula** Fr. (1902).—Re. whitish, becoming greyish and finally blackish, campanulate, transparent, margin sinuate; S. concolorous, filiform, flexuose, pubescent and white at the base; hymenium whitish, pruinose, even, then wrinkled. Dead herbaceous stems. F. ¼ in. diam.

**C. alboviolascens** Karst. (1913).—Re. white, cup-shaped, globose, sessile or nearly so, often proliferous, densely white villose, hairs rough; hymenium pallid or violaceous, smooth. Wood, twigs, etc. F. $\frac{1}{24}$ in. diam.

**C. villosa** Karst. (1914).—Re. white, globose, sessile, gregarious, contracted when dry, externally white-villose with subfusiform, subulate, pointed, rough hairs; hymenium white, concave, even. Herbaceous stems, branches, etc. F. $\frac{1}{24}$ in. diam.

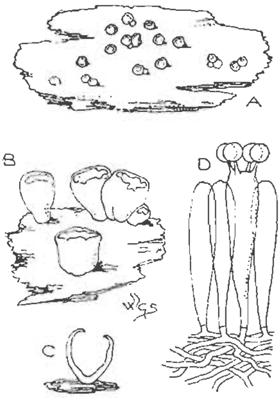


Fig. 87.—*Cyphella brunnea* Phill. (A, × 2; B & C, × 10; D, × 500).

ii. Spores coloured (*Phæocyphella*).

**C. galeata** Fr. (1906).—Re. whitish or grey when moist, snow-white when dry, then rufescent, cup-shaped, then dimidiate, sessile, even, margin white; hymenium finally rufescent, slightly wrinkled; spores tawny. Mosses. ¼ in. diam.

## LXXXIX. SOLENIA Hoffm.

(Greek *solen*, a pipe—from the shape.)

*Solenia* differs from *Cyphella* in the densely crowded habit, in the cups not expanding, and in being seated on a felt-like, then floccose and fugacious mycelium. Lignicolous. There are five British species.

**S. anomala** Fr. (1925).—Re. dingy ochraceous to ferruginous, turbinate or pyriform, externally villose; hymenium pallid, urceolate, margin incurved. Rotten wood etc. C. $\frac{1}{24}$ in. diam.

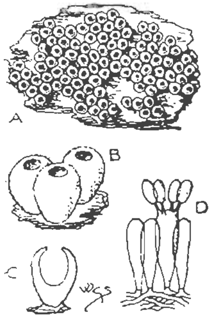


Fig. 88.—*Solenia anomala* Fr. (A, × 5; B & C, × 10; D, × 500).

## Family 5. CLAVARIACEÆ.

The Clavariaceæ have the fruit-bodies erect, dendroid, coralloid, branched, or simple, with the hymenium more or less covering the whole surface. Typically the form is simple, erect, and clavate ("fairy clubs"), a form which is found also in the Ascomycetes, as, for example, *Geoglossum* (p. 184) and *Xylaria* (p. 194).

### *Key.*

| | | |
|---|---|---|
| 1. | Gelatinoso-cartilaginous, viscid | *Calocera.* |
| | Fleshy to coriaceous | 2. |
| 2. | With compact, flat, plate-like branches | *Sparassis.* |
| | Hair-like, much branched | *Pterula.* |
| | Terete, simple, or branched | 3. |
| 3. | Usually large, fleshy, clavate, or branched | *Clavaria.* |
| | Usually minute, simple, filiform, or subclavate | 4. |
| 4. | Stem long, thin, often springing from a sclerotium | *Typhula.* |
| | Stem short, thick | *Pistillaria.* |

## XC. SPARASSIS Fr.

(Greek, *sparasso*, to tear to pieces—from its torn appearance.)

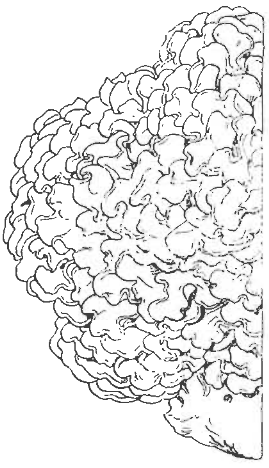

Fig. 89. *Sparassis crispa* Fr. (× ½.)

The fruit-body is fleshy, erect, and much branched, and the branches are flattened in a lamellar or plate-like manner and more or less confluent; the hymenium is smooth and inferior. The two British species grow on the ground, but have a cord-like mycelium, which is often attached to roots of trees.

*Sparassis* is most closely allied to *Stereum*.

**S. crispa** Fr. (1926).—Whitish or pale ochraceous, very much branched, with branches recurved, intricate, crisped, and tinged yellowish at the apex, the whole somewhat resembling a cauliflower; S. whitish, becoming blackish with age, stout, rooting; smell pleasant of anise. Coniferous woods. F. 12×12. Edible.

**S. laminosa** Fr. (1926 *a*).—Differs from 1926 in its more yellowish colour and in its branches being laminar, patent, more lax, and less dense. Mixed woods. F. 10×7. Edible.

## XCI. CLAVARIA Linn.

(Latin *clava*, a club.)

The fruit-body is fleshy or subcoriaceous, erect, branched, or simple and club-shaped; the hymenium is even and amphigenous, but absent from the stem-like portion of the simple clubs. Mostly terrestrial. There are about forty British species, probably none of which are poisonous.

*Certain species are not infrequently attacked by the black mould (Scolicotrichum Clavariarum).*

i. Branched.

141. **C. Botrytis** Pers. (1928). (Greek *botrus*, a bunch of grapes —from the colour of the ultimate branches.)

Fruit-body whitish to buff, forming a fleshy rounded mass with a white, then yellowish, short, stout base tapering downwards; branching irregular, primary branches few and stout, ultimate

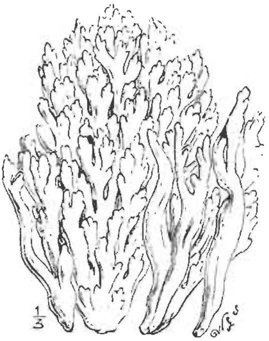


Fig. 90.—*Clavaria cinerea* Bull. (× 1/3.)

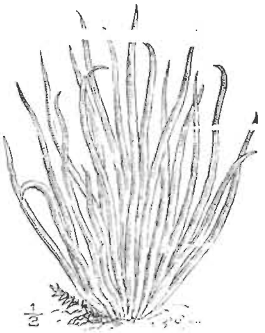


Fig. 91.—*Clavaria vermicularis* Fr. (× 1/2.)

branchlets slender, more or less dichotomous; branches cylindrical, somewhat erect, smooth, pruinose, apices reddish, pointed or toothed; flesh white, solid; smell and taste pleasant.

Woods. Rare. Aug. to Nov. 5 × 5. Edible.

**C. formosa** Pers. (1945).—Differs from 1928 in being very fragile, in the orange-rose or pinkish-buff colour, and in the apices of the branches being yellowish or slightly tinged pinkish. Woods. O. 5×6. Edible.

**C. muscoides** Linn. (1931) (*C. corniculata* Fr.).—Clear egg-yellow, tough; S. short, downy at the base; branches slender, two or three times forked, erect, even, solid, axils lunate, often compressed, apices crescent-shaped, attenuate; flesh somewhat paler. Grass. C. 3×3.

**C. fastigiata** Linn. (1930).—Differs from 1931 only in being very much branched, with the branches crowded, of equal length, and forming a level top. Grass. C. 2×3.

142. **C. cristata** Pers. (1937). (Latin *cristatus*, crested.)

Fruit-body white or with a tinge of pink or mouse-grey, branched, fragile; stem short, slender, or stout; branches numerous, irregular, flattened upwards, and divided at the tips into sharp-pointed crested branchlets; axils roundish; flesh white.

Woods. Common. July to Jan. 3 × 3. Edible.

**C. cinerea** Pers. (1935). Differs from 1937 in the greyish colour sometimes with a tinge of purple, in the usually acute axils, and the wrinkled, irregular, thickened branches with apices often toothed. Woods. C. 6×5.

**C. amethystina** Pers. (1929).—Resembles a stout thick form of 1935, but is violet in colour. Woods etc. O. 2×3.

**C. rugosa** Bull. (1938).—White or pallid, simple or slightly irregularly branched, rather tough; clubs thickened upwards, longitudinally wrinkled, solid, apex blunt, stem not distinct. Woods etc. C. 5 in. high. Edible.

**C. Kunzei** Fr. (1941).—Differs from 1938 in being branched from the thin cæspitose base and in the branches being slender and even. Woods etc. O. 2½ in. high.

143. **C. stricta** Pers. (1952). (Latin *strictus*, close.)

Fruit-body ochraceous, tinged vinous, and becoming fuscous when bruised, branched, apices pale yellow; stem distinct, thick, short, tough with root-like strands of white mycelium at the base; branching irregularly dichotomous, axils acute; branches slender, cylindrical or sometimes compressed, erect, attenuate, apices somewhat pointed, slightly incurved, solid; flesh concolorous; smell strong, spicy; taste bitter.

On rotten wood, stumps, etc. Common. Aug. to Jan. 4 × 3.

**C. abietina** Pers. (1947).—Differs from 1952 in being deep dull ochraceous in colour, becoming greenish when bruised; very much branched, forming spherical tufts; smell strong. Fir woods. F. 3 × 3.

ii. Clubs tufted at the base.

144. **C. fusiformis** Sow. (1957). (Latin *fusis*, a spindle, *formis*, shape.)

Fruit-body bright yellow, elongato-fusiform, attenuate at both ends, smooth, often becoming hollow and compressed with a central furrow, apex acute, rarely toothed; stem not distinct; flesh whitish; taste bitter; densely tufted.

Woods and pastures. Common. July to Dec. 5 in. high.

145. **C. inæqualis** Müll. (1959). (Latin *inæqualis*, unequal.)

Fruit-body bright yellow to rich orange, fragile, elongato-clavate, tapering downwards, smooth or with one or more furrows, apex usually obtuse; stem not distinct; flesh whitish, fibrous; solitary or in small clusters.

Woods, pastures, etc. Common. Aug. to Dec. 5 in. high.

**C. dissipabilis** Britz. (1958).—Has been distinguished from 1959 by its acutely warted spores, whereas the older species is reputed to have smooth spores.

**C. luteoalba** Rea (1957*a*).—Differs from 1959 in its apricot-yellow clubs frequently tipped with white, in its concolorous flesh, and its smaller size. Woods etc. F. 2 in. high.

**C. argillacea** Pers. (1960).—Pale greenish yellow, fragile, cylindrical or flattened, with one or more grooves, surface often minutely channelled, apex blunt; S. distinct, yellowish; taste of tallow. Heathy places. F. 3 in. high.

146. **C. vermicularis** Fr. (1961). (Latin *vermicularis*, pertaining to worms.)

Fruit-body white, very brittle, unbranched, densely tufted, somewhat flexuous, elongato-fusiform, attenuated at both ends, sometimes twisted and compressed, smooth, becoming hollow; stem not distinct.

In long grass in woods and meadows. Common. Aug. to Nov. 4 in. high.

**C. fumosa** Pers. (1964).—Resembles 1961, but is fuliginous in colour, with brown tips. Long grass. O. 4 in. high.

iii. Clubs simple, distinct at the base.

147. **C. acuta** Sow. (1966). (Latin *acutus*, pointed.)

Club glistening white, slender, cylindrical or compressed, smooth, becoming hollow, very brittle, apex acute or obtuse; stem usually distinct from the club.

Amongst short grass and in flower-pots. Sept. to Nov. F. 1 in. high.

148. **C. pistillaris** Linn. (1968). (Latin *pistillaris*, a pestle.)

Club light yellow, then rufescent, finally dingy brown, obovato-clavate, obtuse, pruinose, stuffed; stem not distinct; flesh whitish, loose and cottony in the centre.

Woods. Rather rare. Sept. to Dec. 12 in. high.

**C. ligula** Schaeff. (1969).—Differs from 1968 in the ochraceous colour with a rufescent tinge, in the flattened and smaller clubs, and the white villose base. Woods. R. 4 in. high.

149. **C. fistulosa** Holmsk. (1971). (Latin *fistulosus*, full of holes.)

Clubs yellowish, then date-brown, cylindrical or clavate, often twisted, smooth, hollow with age, occasionally branching at the apex, often contorted at the short, rooting, villose base.

Dead branches. Rare. Nov. to Feb. 10 in. high.

**C. contorta** Holmsk. (1970).—Differs from 1971 in its paler, more greyish colour, its entirely smooth club, without a sterile basal portion, and its dwarf fasciculate habit. Alder branches. R. ½ in. high.

**C. juncea** Fr. (1973).—Differs from 1971 in the much more slender habit; club filiform, rusty to brownish, base creeping, fibrillose. Amongst leaves in woods. O. 5 in. high.

## XCII. CALOCERA Fr.

(Greek *kalos*, beautiful, *keras*, a horn.)

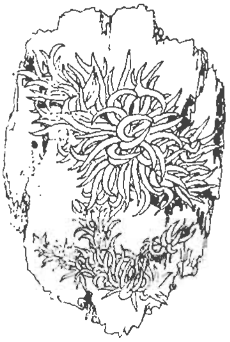

Fig. 92.—*Calocera cornea* Fr. (× ⅔.)

*Calocera* resembles *Clavaria* in habit, but differs in being gelatinoso-cartilaginous, becoming horny when dry, in the basidia having two long sterigmata, and in the spores becoming septate on germination. It is most nearly allied to *Dacryomyces*. The fruit-body is erect, cylindrical, simple, or branched, and the hymenium is smooth and amphigenous. There are about seven British species, all of which are lignicolous.

**C. viscosa** Fr. (1976).—Re. golden egg-yellow, becoming orange when dry, branched, long-rooted, viscid, even, linear; branches concolorous, round or compressed, tense, straight, repeatedly dichotomous, apex generally forked. Coniferous stumps. C. 2½ in. Base 2½ in.

**C. cornea** Fr. (1978).—Re. yellow-orange, awl-shaped, connate at the white, rooting, villose base, sometimes bifid, viscid Wood and branches. C. ½ in. high.

## XCIII. PTERULA Fr.

(Greek *pteron*, a wing.)

*Pterula* resembles *Calocera* in its cartilaginous substance, but its basidia and spores are similar to those of *Clavaria*. The fruit-body is filiform, arid, with or without a stem, branched in the two British species, subulate, with attenuato-acute apices. Growing on wood or on the ground.

**P. multifida** Fr. (1984).—Re. pallid whitish, then dingy pale yellowish, and finally brownish, almost black when dry, very much branched, very delicate, flaccid; branches tense and straight, hair-like, subfastigiate, apices attenuate, pointed, base sometimes thick or with several confluent stems. Dead branches etc. O. 2 in. high.

## XCIV. TYPHULA Fr.

(Latin *Typha*, the reed mace—from the appearance of certain species.)

*Typhula* is closely allied to *Clavaria* and *Pistillaria*. The fruit-body is small, fleshy, waxy or tough, erect, and usually simple, with a filiform stem heterogeneous from the linear or slightly inflated club, and often arising from a sclerotium; the hymenium is smooth and is confined to the clavate portion of the fruit-body. Growing on dead leaves, herbaceous stems, twigs, etc. There are about ten British species.

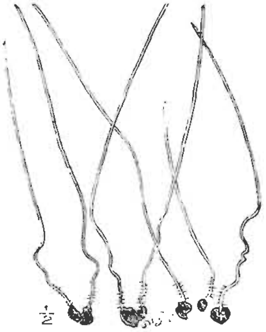

Fig. 93.—*T. phacorrhiza* Fr. (× ½.)

150. **T. phacorrhiza** Fr. (1986). (Greek *phacos*, a lentil, *rhiza*, a root—from the lentil-like base.)

Clubs brownish, filiform, paler and tomentose at the base, flexuose, arising from a compressed, pallid, then fuscous sclerotium; flesh concolorous.

Dead leaves and herbaceous stems. Frequent. Oct. to Nov. 4 in. high.

The sclerotium has been named *Sclerotium scutellatum* A. & S.

**T. erythropus** Fr. (1985).—Re. white, cylindrical, linear, smooth; S. reddish black, often twisted, usually arising from an elliptical, brown, or blackish sclerotium, clothed with concolorous hairs at the base. Dead leaves etc. C. 1 in. high.

151. **T. gracilis** Berk. & Desm. (1993). (Latin *gracilis*, slender.)

Club pallid, simple or forked, acute, with small prominent bristles, rough with spores; stem short, distinct, smooth or strigose with hyaline flexuose hairs.

Rotten leaves. Uncommon. Dec. $\frac{3}{16}$ in. high.

**T. muscicola** Fr. (1989) (*Eocronartium*).—Re. pallid or white, elongate, cylindrical, obtuse, attenuated into a long, thin, smooth S., arising from a minute pallid sclerotium; basidia 3–5 transversely septate. Mosses. O. 1¼ in. high.

## XCV. PISTILLARIA Fr.

(Latin *pistillum*, a pestle.)

*Pistillaria* is closely allied to *Typhula* and *Clavaria*. The fruit-body is small, fleshy or waxy, erect, usually simple, club-shaped,

with a short, thick, glabrous or villose stem, rarely arising from a sclerotium: the hymenium is smooth and confined to the clavate portion of the fruit-body.

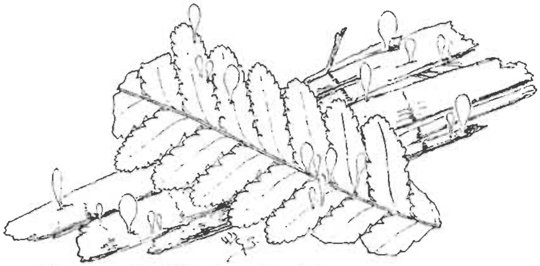

Fig. 94.—*Pistillaria puberula* Berk. (Nat. size.)

**P. micans** Fr. (1997).—Rc. glistening rose-colour, obovate or oblong, pruinose; S. white or concolorous, cylindrical. Dead thistles etc. ¼ in. high.

**P. quisquiliaris** Fr. (1999).—Rc. whitish, ovato-clavate, subcompressed, rarely bifid, attenuate downwards, smooth, sometimes arising from a minute sclerotium. Dead bracken stems etc. C. ¼ in. high.

**P. puberula** Berk. (2000).—Rc. white, obovate, ventricose: S. short, distinct, equal, or attenuate upwards, pellucid, tomentose. Dead bracken stems. F. ¼ in. high.

## Family 6.—TREMELLINACEÆ.

In this family the fruit-body is of a more or less gelatinous consistency, becoming rigid and horny when dry and regaining its form when moistened; the structure is homogeneous.

Most species are difficult to determine without microscopic examination.

I. Basidia transversely septate.
- Broadly attached ... *Auricularia.*
- Attached by a narrow base ... *Hirneola.*

II. Basidia longitudinally, cruciately divided.
- Cupulate, discoid, or foliaceous; hymenium inferior, often papillate; spores producing curved sporidiola ... *Exidia.*
- Pulvinate, gyrose; spores producing straight sporidiola... *Ulocolla.*
- Foliaceous, brain-like, or tubercular; whole surface fertile... ... *Tremella.*
- Convex, with a hard central portion ... *Næmatelia.*
- Erect, subspathulate; hymenium inferior ... *Gyrocephalus.*

III. Basidia simple, with two long pointed sterigmata.
- Pulvinate, gyrose, very small ... *Dacryomyces.*
- Obconic, erumpent, base rooting; spores yellowish, boat-shaped ... *Femsjonia.*
- Irregularly cup-shaped, rooting stem firm and indurated... *Ditiola.*
- Irregularly cup-shaped, disc obliquely attached ... *Guepinia.*

### XCVI. AURICULARIA Bull.

(Latin *auricula*, an ear.)

The fruit-body is gelatinous-coriaceous when moist, cartilaginous when dry, dimidiate or cup-shaped, broadly attached; the hymenium is smooth, reticulately ribbed, or plicate. The one British species grows on wood.

Three layers can be distinguished structurally: a thin and compact upper layer, generally tomentose, with thick simple hairs, an intermediate layer of thin gelatinous hyphæ, and a third layer constituting the hymenium.

Fig. 95.—*Auricularia mesenterica* Pers. (× ⅓.)

152. **A. mesenterica** Pers. (2001). (Greek *mesos*, middle, *enteron*, intestine—from a fancied resemblance to a mesenteric membrane.)

Fruit-body fuscous cinereous, grey, or tawny, resupinate, often cup-shaped, then confluent and reflexed, imbricate, entire or slightly lobed, villose, fasciato-zoned; hymenium pale or greyish, then brownish violet, costato-plicate, pruinose with the spores; flesh fuscous, gelatinous, then cartilaginous.

Stumps and felled trunks, especially of elm. Common. Jan. to Dec. 8 in. diam.

## XCVII. HIRNEOLA Fr.

(Latin *hirnea*, a jug—from the shape when young.)

*Hirneola* differs from *Auricularia* in being narrowly attached to the substratum. Both British species are lignicolous.

153. **H. Auricula-Judæ** Berk (2003). (Latin *auricula*, ear, *Juda*, a Jew.) Jew's Ear.

Fig. 96.—*Hirneola Auricula-Judæ* Berk. (× ⅓.)

Fruit-body grey, then olivaceous or reddish brown, and finally black, cup-shaped, hemispherical, concave, then ear-shaped, flexuose, plicate, transparent, tomentose; hymenium pale, then greyish, and finally fuscous, smooth, then venoso-plicate; flesh whitish, gelatinous, then cartilaginous, tough.

On trunks, especially elder. Common. Jan. to Dec. 3 in. diam. Edible.

Formerly used as a remedy for dropsy and for sore throats.

**H. polytricha** Mont.—Differs from 2003 in the greyish, densely tomentose exterior and pale, then brownish purple, and finally blackish smooth hymenium. O. 3 in. diam.

This species, which has been recorded on wooden fire-bricks in this country, is used in China for mixing with food and, also, for its reputed medicinal qualities. It is largely exported from New Zealand, and, though the trade does not seem so flourishing as formerly, the fungus is still regularly collected in the northern forests, threepence to sixpence a pound being given for dried material. The trade apparently began in 1871 and increased rapidly. During 1918, 2054 cwts. of the fungus, with an estimated value of £5874, were exported from Auckland, mainly to Hong Kong.

## XCVIII. EXIDIA Fr.

(Greek *exidio*, to exude—from the appearance of the hymenium.)

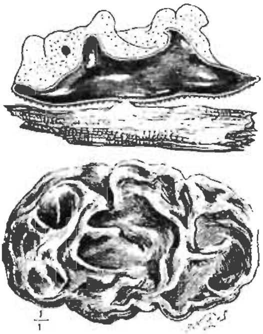

Fig. 97.—*Exidia glandulosa* Fr. (Nat. size.)

The fruit-body is gelatinous, pellucid, globose or hemispherical, marginate, substipate or sessile, cup-shaped and truncate when young, sterile on the upper surface; the hymenium is inferior, smooth, reticulately veined, or papillose; the spores on germination produce strongly curved sporidiola. Growing on wood. There are two British species.

154. **E. recisa** Fr. (2005). (Latin *recisus*, cut off.)

Fruit-body fuscous amber, truncato-plane, hemispherical or obconical, subrepand, rough with dots beneath; stem concolorous, short, oblique, excentric: hymenium brighter coloured, plane, often veined; flesh concolorous, gelatinous, soft, subdiaphanous.

Branches of willow etc. Common. Sept. to Dec. 1½ in. diam.

**E. glandulosa** Fr. (2006) (Witches' Butter).—Olive-grey, then blackish, globose, truncate or pendulous, somewhat plane, undulate, cinereous and subtomentose beneath: hymenium concolorous, studded with conical papillæ: flesh blackish. Branches, especially lime. C. 5 in. diam.

## XCIX. ULOCOLLA Bref.

(Greek *oulos*, shaggy, *kolla*, glue—from the appearance.)

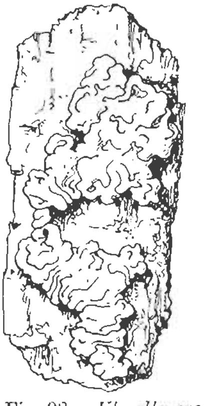

Fig. 98.—*Ulocolla saccharina* Bref. (× ½.)

Differs from *Exidia* in that the spores on germination produce rod-shaped sporidiola. The two British species are lignicolous.

**U. saccharina** Bref. (2008).—Tawny cinnamon, effused, tubercular, gyroso-undulate, sprinkled with a few minute, obtuse, evanescent papillæ. Coniferous trunks etc. O. 3 in. diam.

## C. TREMELLA Dill.

(Latin *tremo*, to tremble.)

The fruit-body is gelatinous or waxy and soft, pulvinate or effused, brain-like or lobed; the hymenium is spread over the whole surface, and is rarely papillate. Conidia are frequently present, and may either precede or accompany the basidia. Growing usually on wood. There are about fifteen British species.

155. **T. frondosa** Fr. (2011). (Latin *frondosus*, leafy.)

Fruit-body yellow or rose-yellow, spathulate or tongue-shaped, large, even, base plicate, lobes gyroso-undulate; flesh concolorous, gelatinous.

Stumps etc., especially oak. Not uncommon. July to Dec. 9 in. diam.

Fig. 99.—*Tremella mesenterica* Retz. (Nat. size.)

156. **T. mesenterica** Retz. (2013). (Greek *mesos*, middle, *enteron*, intestine —from the shape.)

Fruit-body bright orange, variously contorted, brain-like, plicato-undulate, gyrose, pulverulent with the spores; flesh concolorous, gelatinous, becoming firm, tough.

Dead branches and sticks. Common. Jan. to Dec. 3 in. diam.

157. **T. moriformis** Sm. (2020). (Latin *morus*, mulberry, *forma*, shape.)

Fruit-body mulberry-black, erumpent, spherical, sinuous; flesh deep violet, translucent, subgelatinous, firm.

Dead branches. Rare. June to Feb. $1 \times \frac{5}{8}$.

[**PHÆOTREMELLA** Rea resembles *Tremella*, but has dark-coloured spores.

**P. pseudofoliacea** Rea.—Somewhat cinnamon, very much lobed, undulate, smooth, plicate at the base, gelatinous, subdiaphanous. Stumps etc. F. 4 in. diam.]

## CI. NÆMATELIA Fr.

(Greek *naima*, gelatine, *eileo*, to wrap round—from the gelatinous substance surrounding the hard centre.)

*Næmatelia* differs from *Tremella* only in the presence of a solid central "nucleus," composed of interwoven hyphæ.

**N. encephala** Fr. (2025).—Pallid flesh-colour, pulvinate, subsessile, diaphanous, plicato-rugose, white-pruinose, rooting; nucleus white, large, hard; solitary to connate. Branches of conifers. F. 1 in. diam.

Fig. 100.—*Gyrocephalus rufus* Bref. ($\times \frac{1}{2}$.)

## CII. GYROCEPHALUS Pers.

(Greek *gyros*, round, *kephale*, the head.)

The fruit-body is gelatinous, firm, erect, subspathulate or infundibuliform, substipitate or sessile; the hymenium is inferior, smooth, or indistinctly veined. There is one British species.

**G. rufus** Bref. (2029).—Rosy orange, becoming red, erect, subspathulate deeply infundibuliform, usually substipitate, diaphanous, entire, or lobed; hymenium concolorous, white-pruinose. Under conifers. O. $4 \times 3$. Edible.

## CIII. DACRYOMYCES Nees.

(Greek *dakru*, a tear, *mukes*, a fungus—from the appearance.)

The fruit-body is gelatinous or subgelatinous, homogeneous, small, subglobose, often becoming cup-shaped and sometimes flattened, sessile; the hymenium is smooth, wrinkled, or folded, and covers the whole of the exterior. The fruit-body also produces conidia. Growing on wood. There are about seven British species.

**D. deliquescens** Duby (2031).—Yellow, translucent, convex, rounded or irregular when confluent, often slightly plicate or gyrose, sometimes substipitate; conidial form bright orange. Dead wood etc. C. $\frac{1}{8}$ in. diam.

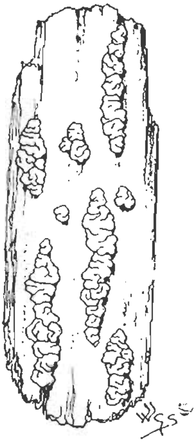

Fig. 101.—*Dacryomyces deliquescens* Duby. (× ½.)

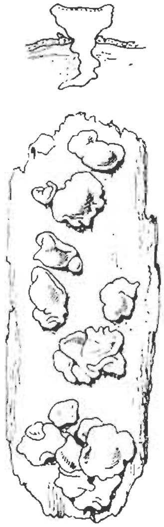

Fig. 102.—*Femsjonia luteo-alba* Fr. (× ½.)

## CIV. FEMSJONIA Fr.

(*From Femsjo, in Sweden.*)

The fruit-body is gelatinous or floccose, heterogeneous, erumpent, convex, then plane, obconic, and sessile; the hymenium is smooth, then wrinkled. One British species, growing on wood.

**F. luteoalba** Fr. (2036*a*). *Disc bright golden yellow, with a narrow white margin, becoming wrinkled with age, white-tomentose below, cup-shaped, then disc-shaped and plane, finally convex and folded, somewhat rooting.* Branches. F. ½ in. diam.

## CV. GUEPINIA Fr.

(After Jean Pierre Guépin, a French botanist.)

The fruit-body is cartilagineo-gelatinous, unequally cup-shaped, and substipitate; the hymenium occurs on the upper surface. The two British species grow on wood.

**G. Peziza** Tul. (2037).—Amber-yellow, often irregular and with linear folds on the exterior, margin thin and waved; S. slender; flesh yellowish, diaphanous, gelatinous, then firm. Dead branches etc. O. $\frac{3}{8} \times \frac{1}{2}$.

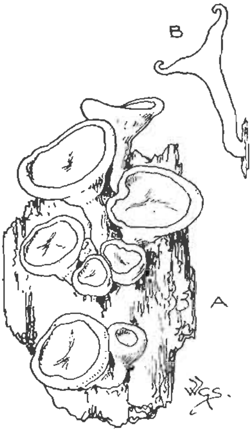


Fig. 103.—*Guepinia Peziza* Tul. (A & B, × 2; C, basidium and spores, × 500.)

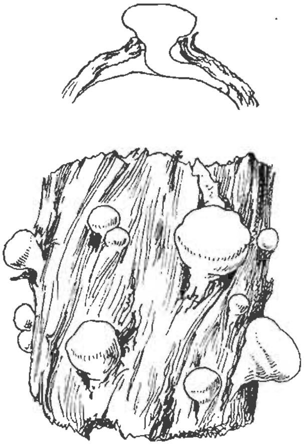

Fig. 104. *Ditiola Ulicis* Plowr. (× 2.)

## CVI. DITIOLA Fr.

(Greek *dittos*, double, *ioulos*, down—from the down-like universal veil.)

The fruit-body is gelatinous or subgelatinous, sometimes becoming horny, cup-shaped, tubercular, or globose, sometimes branched or lobed, stipitate or substipitate; the hymenium is discoid, unilateral, and smooth. Growing on wood. There are three British species.

**D. radicata** Fr. (2039).—Orange, tubercular, then nail-shaped, convex, subviscid, margin obtuse; S. whitish, soon concolorous, rooting. Coniferous wood etc. O. $\frac{1}{8} \times \frac{1}{4}$.

**D. nuda** B. & Br. (2040) (*Dacryomitra*).—Reddish orange, head hemispherical, flattened below; S. white or tinged yellow, minutely tomentose; hymenium with conidiophores and basidia. Fir stumps. R. $\frac{1}{8} \times \frac{1}{4}$.

[**STILBUM** Tode.—Re. erect, globose, stipitate; hymenium of branched threads terminating in short, pyriform, transversely 1-septate basidia. Previously regarded as a Hyphomycete.

**S. vulgare** Tode.—White, then yellowish; S. attenuate upwards, fibrous, smooth. Rotten wood etc. C. $\frac{1}{5}$ in. high.

**ECCHYNA** Fr. Pe. subglobose, stipitate or substipitate, fibrillose, then fugacious; gleba threads radiating; basidia transversely 3-septate, bearing sessile or shortly pedicellate, fawn-coloured spores.

**E. faginea** Fr. (*Pilacre faginea* B. & Br., *P. Petersii* Berk. & Curt.).—Pe. whitish or fawn-colour; S. concolorous, becoming black with age; flesh fawn-colour, floccose, loose. Tree-stumps etc. $\frac{1}{4}$ in. high.

The hymenium being enclosed within a peridium suggests relation with the Gasteromycetes.]

# Order II. GASTEROMYCETES.

This second main division of the Basidiomycetes is distinguished by the fact that the hymenium is enclosed until the spores are mature within a continuous membrane or *peridium*. This wall is of one to three layers; when more than one layer is present the outer one is called the *exoperidium*, the inner the *endoperidium*. The contents of the peridium are collectively known as the *gleba*. In the young stage the gleba is traversed by the hymenial tissue, which is borne on tramal plates, forming variously shaped cavities which are either persistent or deliquescent; or the hymenium may be enclosed in separate structures known as *peridiola*. In certain genera the hyphæ of the trama give origin also to elongated, thick-walled, simple or branched hyphæ which frequently form a dense mass, the *capillitium*, in the interior of the fruit-body.

Most Gasteromycetes arise from cord-like strands of mycelia, or rhizomorphs.

## Family 1.—PHALLOIDACEÆ.

In this family the fruit-body, which is known as the receptacle, is at first enclosed in an oval or globose peridium ("egg"), which consists of three layers, the middle one of which is gelatinous; the peridium ruptures at the apex, the lower portion forming a volva; the gleba is mucilaginous and attached to a stem-like or trellised receptacle and is finally borne upwards.

The raising of the stalked receptacle is the result of extremely rapid growth —*Phallus* attains its full size in about half an hour after the bursting of the peridium—and is favoured by an abundant supply of water, most of which is contained in the egg. The growth takes place chiefly in the pseudoparenchymatous cells of the wall.

**Development.**—The Phalloidaceæ are usually grouped according as to whether the gleba is borne internally or externally. In the former case (*Clathrus*, *Lysurus*) the tramal plates develop as peripheral folds of the surface of the axillary tissue of the central strand and continue their growth in a radial, centrifugal manner, whereas in the latter case (*Phallus*, *Mutinus*) they originate in the interior of the axillary tissue on the underside of a differentiated campanulate portion and radiate inwards towards the axis of the fruit-body.

In *Phallus* the structure of the very young stage of the egg corresponds very closely with that of the growing ends of the mycelial cords, possessing a central core and a cortex. The position and extent of the central strand is very variable, and, according to Atkinson, there is no direct continuation of the strand into the middle portion. In the centre of the broadened end a homogeneous compact tissue arises, composed of intricately interwoven hyphæ rich in protoplasm: this tissue by growth and differentiation later gives rise to the parts of the mature plant. The first indication of the differentiation of the primordium is a gelatinisation of hyphæ in the extreme upper portion just inside the cortical layer, forming a small circular area, which progresses centrifugally and downwards from its edge. This forms the thick gelatinous middle layer of the volva. Meanwhile, the fundament of the stem appears as a delicate columnar structure, the central portion consisting of primordial tissue, while the fundament of the wall extends nearly up to the apex of the bell-shaped structure inside the gelatinous layer which forms the inner wall of the peridium. Immediately within the latter is the fundament of the gleba. Further within, another bell-shaped area represents the fundament of the inner portion of the pileus. The fundament

of the gleba now gives rise on its inner surface to a palisade layer of slender clavate cells, which, in developing, form numerous folds with furrows between them, branching profusely as they extend inward toward the forming pileus. At maturity this fundamental tissue lies between the stem and the pileus as a thin delicate membranous layer, which also extends below the pileus around the lower end of the stipe. As the stem elongates and the pileus extends somewhat. this delicate "veil" is torn, fragments being left on the surface of the stem which soon collapse and disappear.

In *Mutinus* the egg in its earliest stages consists of central and medullary tissues continued directly upward from the strand. The medullary bundle spreads out at its upper end and forms a dense sheaf-like head by repeated branching and anastomosing. The cortical layer of tissue becomes the outer wall of the volva, whereas the sheaf-like head gradually differentiates into all the other parts of the older egg. The central column first appears, arising from the axial tissue of the head. The formation of the gelatinous layer of the volva now begins in the periphery of the head. The dense portion between the peripheral zone and the central column takes on a dome-shape. Along the inner surface of this, and next to the intermediate tissue, the rudiment of the gleba arises from the clustered swollen ends of lateral branches of the tramal tissue. These hyphal ends form a palisade layer facing the intermediate tissue and by the crowding in of new hyphal ends (basidia) the surface of the layer becomes greatly enlarged and thrown into folds, and torn from the intermediate tissue. The rudiment of the stipe arises in the intermediate tissue lying next to the central column. Somewhat later, masses of tissue in the dense and intricately interwoven rudiment of the stipe show a tendency toward gelatinisation. These masses mark the position of the chamber cavities in the wall, and toward the upper end of the stipe where they are in contact with the central column they mark the position of the pits which in the mature stages open into the main central cavity of the stipe. The chamber walls are thrown into folds through a more rapid growth of the pseudoparenchyma than that of other parts of the egg, and final elongation of the stipe, and elevation of the gleba, is brought about through the straightening out of the folds.

In *Lysurus* all the tissues of the egg arise from the internal differentiation of the medullary and cortical tissues of the mycelial strands. The medullary portion gives rise to the column of gelatinous tissue in the main cavity of the stipe, the diaphragm, the gleba, and the gelatinous and inner layers of the peridium, while the cortical layer gives rise to the outer wall of the peridium, the radial walls, and the cortical sheath of loose tissue outside the stipe. The receptacle is formed by the joint action of both cortical and medullary tissue, the cortical constituent developing into the pseudoparenchyma of the walls, while the enclosed medullary bundles of the chambers finally become gelatinous and disappear.

In *Clathrus* the earliest stage of the egg consists of cortical and medullary systems continued upward from the mycelial strand. The cortical portion gives rise to the outer layer of the volva, the cortical plates, and the pseudoparenchyma of the receptacle. The medullary portion gives rise to the gelatinous layer of the volva, to the gleba, and to the gelatinous tissue of the chambers of the receptacle. The masses of cortical tissue separating the medullary gelatinous outgrowths from each other retain their connection with the outermost layer throughout all the later development of the egg, and are called cortical plates by Burt; their position is indicated by shallow furrows on the surface of the egg. Along the inner edge of each central plate a cavity forms by the separation of the two systems of tissue in that region. The medullary tissue facing these cavities gives rise to the gleba and to branching hyphal masses, which project outwards and upward into the cavities, becoming the chamber-tissue of the receptacle.

## *Key.*

I. Gleba external.

Pileus attached only at the tip; apex perforate ........ ........ ........ *Phallus.*

Pileus adnate; apex imperforate ........ ........................ ........ *Mutinus.*

II. Gleba internal.

Receptacle forming a hollow lattice ........................................ *Clathrus.*
Receptacle stipitate, dividing into free arms at the apex ......... *Lysurus.*
Receptacle stipitate with a disc at the apex, from which arms radiate ........................................................................ *Aseroe.*

## CVII. **PHALLUS** Pers.

(Greek *phallos.*)

The cap is reticulate and attached by the apex to the summit of a hollow, cylindrical, perforate, spongy, stem-like receptacle by a narrow disc, and is covered on the outside with the mucilaginous gleba; the egg is globose and is torn above into irregular lobes by the developing receptacle, leaving a volva at the base. Terrestrial. There are two British species.

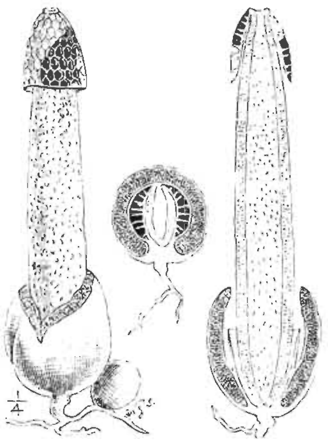

Fig. 105.—*Phallus impudicus* Pers. (× ¼.)

158. **P. impudicus** Pers. (2042). (Latin *impudicus*, shameless.)

Cap white, cylindrical, at first covered with green mucus, reticulated externally; receptacle white, elongato-fusiform, spongy, cellular, perforate at the apex; volva white or yellowish, attached to dense masses of white cord-like mycelium; smell very fœtid.

Woods, thickets, gardens, generally amongst rotten tree-roots etc. Common. May to Nov. 10 in. high. Edible when unexpanded.

**P. imperialis** Schulz. Differs from 2042 in the pink volva, with pinkish or pale blue mycelial cords, in the slightly pinkish base of the Re., in the broad attachment-disc which becomes yellowish and crenate, and in the smell of liquorice. On sand dunes. R. 10 in. high.

## CVIII. **MUTINUS** Fr.

(An appellation of Priapus.)

*Mutinus* differs from *Phallus* in having the cap wholly adnate to the receptacle, which is imperforate above. There are two British species (one introduced).

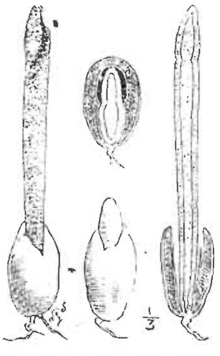

Fig. 106.—*Mutinus caninus* Fr. (× ⅓.)

159. **M. caninus** Fr. (2043). (Latin *caninus*, of a dog.)

Cap red, adnate to the apex of the receptacle, short, acutely digitaliform, rugulose, at first covered with green mucus; receptacle white or rosy, elongato-fusiform, cellular; volva white or yellowish, attached to a white cord-like mycelium; smell slight.

Amongst leaves and on old stumps. Common. June to Dec. 5 in. high.

## CIX. CLATHRUS Mich.

(Latin *clathrus*, a lattice.)

The receptacle is in the form of an obovate or globose hollow lattice, covered on the inside with the mucilaginous gleba. One British species.

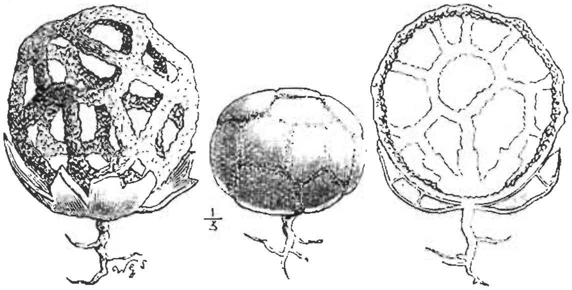

Fig. 107.—*Clathrus cancellatus* Linn. (× ⅓.)

160. **C. cancellatus** Linn. (2045). (Latin *cancellatus*, latticed.) Receptacle vermilion or pinkish red, sessile, forming a hollow pentagonal network, perforated in lattice-fashion, triangular in section, flattened on the outer surface, torn, irregular and covered with olive-brown mucus on the inner surface; volva white, marked in the egg-stage with lines corresponding to the lattice within, attached to white mycelial cords; very fœtid.

Plantations, gardens, stoves. Oct. to Nov. Rare. 5 × 3½.

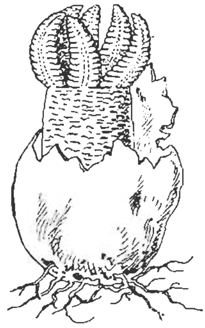

Fig. 108.—*Lysurus australiensis* Cooke & Mass. Young plant. (× ½.)

## CX. LYSURUS Fr.

(Greek, *oura*, tail, *lusis*, loosing—from the free tail-like lobes of the receptacle.)

The receptacle is stipitate, and divides at the apex into free arms and lobes, which are distinct from the stem and bear the mucilaginous gleba; the peridium is globose. Growing on the ground. One British (introduced) species.

**L. australiensis** Cooke & Mass. (2045 *a*).—Pe. white, globose, becoming torn above into irregular lobes, attached to the soil by cord-like mycelial strands; Re. whitish, cylindrical, attenuate at the base, hollow, cellular, dividing at the apex into six arms; arms deep reddish brown, attenuate upwards, with a longitudinal groove along the middle and transversely ribbed. Pasture amongst sack refuse and amongst stable manure. R. 6¾ × ⅘.

## CXI. ASEROE Labill.

(Greek *aseros*, disgusting.)

*Aseroe* differs from *Lysurus* in that the arms of the receptacle radiate from a disc. One British (introduced) species.

**A. rubra** Labill.—Re. stipitate, red or pale rose, volvate, pervious at the apex, which is expanded into a bright red disc, from which five to eight bifid arms radiate. On soil from Australia. R. 2 × 1¼.

## Family 2.—LYCOPERDACEÆ.

In this family the fruit-body is variously shaped and is provided with a double wall, which opens at the summit or tears irregularly. The gleba is white and fleshy at first, becoming a powdery mass at maturity, intermixed with a well-marked capillitium. The "puff-balls" are typical representatives of the family.

**Development.** In *Lycoperdon* and *Geaster* the young gleba shows lighter, loose hyphal portions, which later tear and thus form cavities for spore formation. The fertile cavities are elongate, the sterile ones round. In *Bovista* cavity formation is similar, except that the tissue is torn further apart and the cavities fuse later to form labyrinthine chambers.

### *Key.*

I. Stem distinct.
  1. Endoperidium biconvex, fibrous; with a well-marked volva at the base of the stem ........ *Battarrea.*
     Endoperidium subglobose ........ 2.
  2. Dehiscing by an apical stoma; stem inserted in a socket at the base of the peridium ........ *Tulostoma.*
     Dehiscing by the breaking away of the walls from below upwards; stem with revolutely squarrose fibrils ........ *Queletia.*

II. Stem indefinite or absent.
  3. Exoperidium splitting in stellate manner ........ *Geaster.*
     Exoperidium warted, verrucose, or smooth ........ 4.
  4. Sterile base present ........ *Lycoperdon.*
     Sterile base absent ........ *Bovista.*

## CXII. BATTARREA Pers.

(After A. J. A. Battarra, author of *Fungorum agri.*)

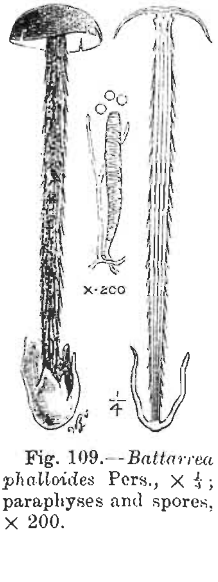


Fig. 109.—*Battarrea phalloides* Pers., × 1/4; paraphyses and spores, × 200.

The receptacle is enclosed at first in a peridium, which ruptures at the apex and leaves a volva-like portion; the stem is elongated, and bears at its summit the cap-like inner peridium.

161. **B. phalloides** Pers. (2046). (Greek *Phallus*, *eidos*, like.)

Receptacle rusty brown, convex, fibrous, splitting horizontally, filled with rust-coloured spores and yellowish-brown capillitium; stem concolorous, attenuate at both ends, woody, firm, covered with long twisted fibres, hollow, with a central pith of silky threads; peridium white outside, parchment-like, pitted, globose and filled with concolorous mucus when young, then splitting irregularly above, and leaving an ovate volva formed of two white membranes with an internal gelatinous olive-yellow layer; subterranean, then superficial.

Sandy places and in hollow trees. Rare. Sept. to Dec. 12×2.

## CXIII. TULOSTOMA Pers.

(Greek *tulos*, cartilage, *stoma*, a mouth).

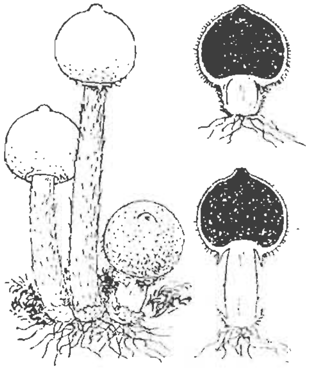

Fig. 110. *Tulostoma mammosum* Fr. (× ⅔.)

The peridium is subglobose; the outer peridium is thin and fugacious, the inner peridium is membranous, thin, and dehisces by an apical aperture; the thickened base elongates into a distinct stem; subterranean, then superficial. There is a single British species.

**T. mammosum** Fr. (2047).—Pe. whitish, then yellowish, globose or subdepressed, mouth small, mammiform, entire; S. reddish brown, equal, squamoso-fibrillose, ragged at the base with the remains of the V. Sand and old walls. O. $2\frac{1}{2} \times \frac{1}{4}$.

## CXIV. QUELETIA Fr.

(After L. Quélet, a French mycologist.)

The peridium is subglobose at first, the sterile base becoming elongated into a distinct stem; the outer peridium is thin and fugacious, the inner peridium is firm and hard, and dehisces by the gradual falling away of the walls from below upwards; subterranean, then superficial. There is a single (introduced) British species.

**Q. mirabilis** Fr. (2048).—Pe. whitish; endoperidium yellowish, becoming brownish; S. whitish, then concolorous, torn into revolute squarrose fibrils, and finally breaking away from the Pe. and exposing the rusty-brown gleba. On old tan. R. $6 \times 2\frac{1}{2}$.

Only five collections of this fungus are known, three from France, one from America, and one from this country.

## CXV. GEASTER Mich.

(Greek *ge*, the earth, *aster*, a star).

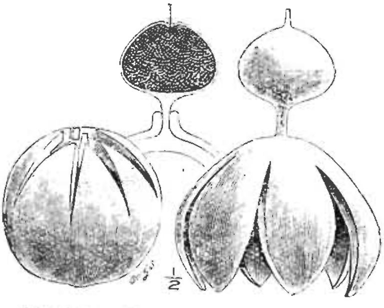

Fig. 111.—*Geaster limbatus* Fr. (× ½.)

The wall is at first continuous and consists of three layers; the two outer layers form the exoperidium—a fibrous or mycelial layer and a pseudoparenchymatous layer which splits into several lobes from the apex downwards; the innermost layer, the endoperidium, is sessile or stalked, and furnished at the apex with a single orifice, rarely more. Terrestial. There are about fifteen British species.

*i. Endoperidium with many orifices.*

162. **G. coliformis** Pers. (2049) (*Myriostoma*). (Latin *colum*, a strainer, *forma*, shape.)

Outer peridium ochraceous, round, covered with large, angular, dark brown scales, splitting almost to the middle into four to seven acute segments; inner peridium lead-colour, or brownish with a silvery sheen, minutely warted, rounded, compressed, borne on numerous slender, angular or cylindrical, sometimes branched pedicels; mouths numerous and ciliate; columellas numerous, filamentous, branched or simple; gleba umber.

Sandy soil. Rare. October. $5\frac{1}{2}$ in. diam. (expanded).

ii. Endoperidium with a single orifice.

*a.* Endoperidium pedicellate.

163. **G. limbatus** Fr. (2053). (Latin *limbatus*, fringed.)

Outer peridium blackish or dark brown, globose, splitting almost to the middle into seven to ten unequal acute segments, expanded or recurved, leathery, flexible, fibrillose, dark brown or grey inside, fleshy, smooth or cracked; inner peridium grey, sometimes light or dark brown, globose or subpyriform, compressed, sometimes swollen at the base near the apex of the stem; mouth depressed, conical, sublacerate, fimbriato-ciliate, often surrounded by a pale silky disc; stem concolorous or paler, compressed; gleba dark umber.

Woods, hedgerows, amongst firs, and leaves. Uncommon. Sept. to Nov. 4 in. diam. (expanded).

**G. fornicatus** Fr. (2054). Exoperidium yellowish, divided into four or five segments, separating into two layers, the outer one cup-shaped, brown and scurfy externally, tan within, remaining in the ground, the inner layer divided beyond the middle, arched, and attached to the outer by the tips of the segments, hard, leathery, thick, the fleshy layer cracking and peeling off in places; endoperidium rust-colour or dark brown, obpyriform, somewhat downy, with a ring-like apophysis above its attachment to the short, whitish, cylindrical S.; peristome conical, then tubular, ciliate. Meadows etc. O. 6×3.

**G. coronatus** Schaeff. Resembles a small and slender 2054; the peristome is projecting, with the surface often covered with white crystals. Coniferous needles. O. $4\times1\frac{1}{2}$.

*b.* Endoperidium sessile.

164. **G. mammosus** Chev. (2059). (Latin *mammosus*, full-breasted.)

Outer peridium ochraceous variegated with white, globose, splitting nearly to the base into seven to ten acute, somewhat narrow lobes, very hygroscopic, strongly inrolled when dry, often umbilicate at the base, smooth and chestnut-brown inside; inner peridium yellowish or light brown, globose, sessile, smooth; mouth conical, acute, fimbriato-ciliate, surrounded by a pale silky disc; gleba vinous or dark brown.

Sandy woods and fields. Uncommon. Feb. to Dec. $1\frac{3}{4}$ in. diam. (expanded).

**G. fimbriatus** Fr. (2061). Exoperidium ochraceous, with white cracks, splitting into five to fifteen unequal segments, strongly recurved below, forming a convex cushion at the base of the globose, sessile, concolorous endoperidium;

outer layer membranous, inner layer deep ochraceous, fleshy, soon cracked, often peeling off; mouth indeterminate, piloso-fimbriate: gleba brown. Woods etc. C. 2½ in. diam.

*G. hygrometricus* Pers. (2062) (*Astræus*). Exoperidium grey or greyish brown outside, brownish inside and becoming deeply cracked, globose, tough, leathery, cartilaginous, splitting almost to the base into seven to twenty acute lobes and rigidly inflexed when dry: endoperidium grey or brown, sessile, dehiscing by a small apical mouth: gleba crimson-brown. Woods. O. 2¼ in. diam.

## CXVI. LYCOPERDON Linn.

(Greek *lukos*, a wolf, *perdon*, dung.)

The wall is composed of two layers—an outer layer which becomes broken up into spine-like tufts or warts, and an inner smooth layer which dehisces by a small apical aperture or by the gradual falling away of the upper surface: a sterile base is present and is usually stem-like. There are about eighteen British species, mostly terrestrial. Probably all are edible in the young state.

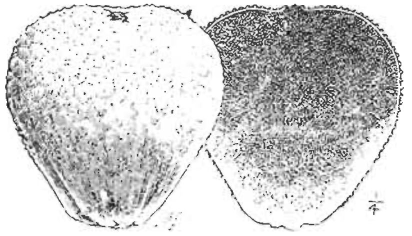

Fig. 112.—*Lycoperdon cælatum* Bull. (× ½.)

165. **L. Bovista** Linn. (2075). (German *bofist*, a puff ball.)

Fruit-body white, then yellowish or olivaceous, globose or depressed, oval, usually plicate at the base, sessile, attached to a cord-like mycelium: outer layer tomentose at first, then becoming smooth and glossy, fragile, finally cracking and falling away from the thin inner layer, which is brittle and evanescent above: gleba white, then yellowish, and finally olivaceous, compact: sterile base very thin or almost absent; spores olivaceous or brownish, capillitium brown.

Pastures, orchards, etc. Common. May to Nov. Edible. 12 × 11.

An American example has been described, measuring 5 ft. 4 in. in its greatest diameter by 4 ft. 6 in. in its least, and 9½ in. high.

166. **L. cælatum** Bull. (2074). (Latin *cælatum*, engraved.)

Fruit-body white, then ochraceous, and finally tinged brownish, subglobose, oval, or depressed, contracted below into a short, stout, tapering, stem-like base, with thick mycelium; outer layer floccose, covered with large distant warts, and cracking into net-like areolæ, warts evanescent above and separating in patches from the thick fragile inner layer, which falls away in pieces, leaving the cup-like sterile base with its diaphragm; gleba white, then yellowish, and finally olivaceous, compact; sterile base thick, persistent, forming nearly half the peridium, separated from the fertile portion by a distinct membranous diaphragm; spores dark olivaceous; capillitium yellowish.

Woods, heaths, pastures, etc. Common. May to Nov. 7½ × 6¾. Edible.

**L. excipuliforme** Pers. (2066).—Pe. *greyish, becoming tinged with yellow or* brown, globose, often compressed, plicate on the underside, and continued into a stout, sterile, S.-like base, which becomes yellowish or greenish: exoperidium of long, delicate, floccose spines, smaller below; *endoperidium floccose, thick, firm, very gradually disappearing in the upper portions*: gleba white, then yellowish, and finally brownish olivaceous. Woods etc. F. $3\frac{1}{2}$ in. diam. Edible.

**L. saccatum** Fr. (2067).—*Pe. whitish or greyish, finally tinged brownish*, rounded above, obtuse, plicato-lacunose below, and continued into a long cylindrical or subventricose, often scrobiculate, S.-like sterile base; exoperidium of small spiculose warts *split at the base and granules, which soon disappear from the upper* portion; endoperidium concolorous, very thin, fragile, falling away in patches; gleba white, then yellow, and finally olivaceous, compact. Woods etc. F. 4 in. diam. Edible.

**L. depressum** Bon. (2074 *a*).—Pe. yellowish white, then greyish yellow, and finally brownish, obconic, rounded at both ends, then flattened on the top, more or less *contracted at the base and plicate*; exoperidium composed of whitish spines united at the apex, intermixed with minute simple spines and furfuraceous granules; endoperidium concolorous, dehiscing by a well defined apical aperture, which *extends until the whole of the upper portion disappears*; gleba white, then yellowish, and finally fuscous olivaceous, separated from the sterile base by a distinct membranous diaphragm; sterile base often forming half of the Pe. Heaths etc. C. $1\frac{1}{4} \times 1\frac{1}{4}$. Edible.

167. **L. gemmatum** Batsch (2068) (*L. perlatum* Pers. 2071). (Latin *gemma*, a bud—from the appearance of the peridium.)

Fruit-body snow-white, then yellowish, and finally brownish, turbinate or subglobose with an elongated, cylindrical, sterile, stem-like base, umbonate, usually plicate below and lacunose, attached, often in pairs, to a white cord-like mycelium; outer layer consisting of acute or obtuse spines, each surrounded by a ring of smaller obtuse warts, which give a net-like appearance to the inner layer when the spines fall away; mouth small; gleba white, then greenish yellow, and finally olivaceous; columella prominent, elliptical, loose.

Woods and pastures. Common. July to Nov. $2\frac{1}{2} \times 4$. Edible.

**L. echinatum** Pers. (2063). Pe. white, then ochraceous, and finally brown, obovate or subglobose, often compressed, attached to a long, white, cord-like mycelium; exoperidium composed of long conical warts, surrounded at their base by a ring of minute, mealy warts which present a net-like appearance when the conical warts disappear; mouth simple, apical, torn; gleba olivaceous, then violet or brownish purple; sterile base about one-third of the Pe. Beech woods etc. O. 2 in. diam. Edible.

**L. pyriforme** Schaeff. (2070). Pe. white, grey, or brownish, pyriform or subglobose, subumbonate, attached at the base to long, white, cord-like mycelial strands, thin, flaccid; exoperidium composed of minute, fugacious, pointed spines and granules; endoperidium concolorous, smooth; gleba white, then greenish yellow, and finally brownish; sterile base white, becoming discoloured, S.-like. Cæspitose on stumps etc. C. $1\frac{1}{4} \times 2\frac{1}{4}$. Edible.

## CXVII. BOVISTA Pers.

(German *bofist*, a puff-ball.)

*Bovista* differs from *Lycoperdon* in the absence of a sterile base. Terrestrial. There are about six British species.

168. **B. plumbea** Pers. (2078). (Latin *plumbeus*, lead-colour.)

Fruit-body white, then lead-colour, globose or depressed; outer layer white, thin, smooth, soon peeling off, sometimes leaving a

persistent portion near the base; inner layer lead-colour, thin, tough, opaque, mouth apical, round, oval, or irregular; gleba white, then ochraceous or olive, and finally purplish brown, soft, loose; capillitium and *spores brown*.

Pastures and heaths. Common. Jan. to Dec. 1¾ × 1¾. Edible.

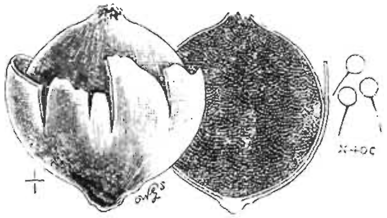

Fig. 113. *Bovista plumbea* Pers., nat. size; spores. × 400.

**B. nigrescens** Pers. (2079). Differs from 2078 in its usually larger size, in being finally dark brown or umber-brown, and in the spore mass having a purplish tinge. Pastures etc. C. 2½ × 2¼. Edible.

**B. ammophila** Lév. (2081) (*Bovistella*). Whitish, then pallid, broadly ovate, plicate below, and attenuated in a long, slender, tap-root-like base, thin, brittle, rigid; exoperidium whitish, broken into tomentose warts; endoperidium pallid, thin; mouth small, apical, irregular, torn; gleba dark brown; sterile base of large cells, very firm, rigid, about one-third of the Pe. Sandy places. R. 1½ × 1¾ (without root).

**GLISCHRODERMA** Fuckel.—Pe. globose, seated on a ring-like mass of white mycelium, dehiscing by a well defined apical aperture.

**G. cinctum** Fuckel.—Pe. pale grey, becoming darker with age, slightly sticky, then scurfy; spores pale pink. Charcoal heaps in woods. O. ½ in. diam.

## Family 3.—SCLERODERMACEÆ.

In this family the fruit-body is subglobose, sometimes with a well-defined stem-like base, and is superficial at maturity. The wall is thick, frequently warted, and dehisces irregularly. The gleba is traversed by sterile veins, and the capillitium is rudimentary.

*Key.*

Peridium membranous; gleba composed of numerous distinct cells, each containing a peridiolum .......... *Polysaccum.*
Peridium leathery or corky; gleba cellular, pulverulent .......... *Scleroderma.*

## CXVIII. POLYSACCUM DC.

(Greek *polus*, many, *saccos*, a bag—from the numerous cells within the peridium.)

The fruit-body is irregularly globose and attenuated downwards into a more or less elongated stem-like base, with a thin membranous wall, dehiscing by the irregular rupture of the apex; the gleba is traversed by sterile veins, forming round or polygonal peridiola which finally separate from each other. There is one British species.

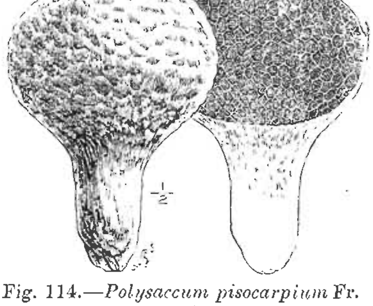

Fig. 114.—*Polysaccum pisocarpium* Fr. (× ½.)

169. **P. pisocarpium** Fr. (2085) (*Pisolithus arenarius* A. & S.). (Latin *pisum*, a pea, *carpellum*, a fruit—from the shape of the peridiola.)

Fruit-body ochraceous, then olivaceous-brown, irregularly globose or ovate, attenuated downwards into a more or less stout stem-like base sunk into the ground and attached to thick, yellow, mycelial cords, smooth or subtuberculose; peridiola sulphur-yellow, then brown, numerous, oval or irregularly angular by pressure, slightly hairy.

Sandy soil. Very rare. May to Oct. $2\frac{3}{4} \times 3\frac{3}{4}$. Edible.

## CXIX. SCLERODERMA Pers.

(Greek *skleros*, hard, *derma*, skin.)

The fruit-body is sessile or prolonged into a short stem-like base: the wall is firm and leathery or corky, warted, scaly, granular or smooth, breaking up irregularly and in a more less stellate manner, clearly marked off from the gleba which is traversed by sterile veins, and finally becomes powdery. Terrestrial. There are about five British species.

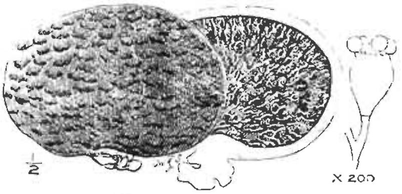


Fig. 115.—*Scleroderma vulgare* Hornem.. × ½ : basidium. × 200.

170. **S. vulgare** Hornem. (2086); *S. aurantium* Pers.). (Latin *vulgaris*, common.)

Fruit-body whitish or yellowish, globose, sessile or substipitate, often depressed, verrucose or adpressed-scaly, with a thick, tough wall, and often attached to a dense mass of white cord-like mycelium at the base: interior greyish white, then blackish with a purple tinge, marbled with the white sterile veins; dehiscing by an irregular mouth; odour often disagreeable.

Open places near trees. Common. July to Jan. 4 in. diam.

Frequently used for the adulteration of pâté de fois gras, sausage, and poulard truffé in place of *Tuber macrosporum*, the French truffle. This and the following species are sometimes attacked by *Boletus parasiticus* (1481).

171. **S. verrucosum** Pers. (2087). (Latin *verrucosus*, warted.)

Fruit-body ochraceous or dingy brown, subglobose, continued below into a more or less elongated stem-like base, sometimes almost sessile, covered with minute darker warts or finely squamulose, rarely almost smooth, wall thin above and fragile; interior umber-brown or purple-brown marbled with the white sterile veins.

Sandy soil. Common. July to Nov. $3 \times 5$.

## Family 4.—NIDULARIACEÆ.

The Nidulariaceæ are characterised by having the basidia and spores produced in separate indehiscent structures known as peridiola, which are enclosed in the peridium. The typical members of the family are popularly known as "birds'-nest fungi."

**Development.**—The fruit-bodies of *Nidularia*, *Cyathus*, and *Crucibulum* arise from mycelial strands or from dense hyphal mats. The primordium seems to have its origin slightly below the tip of the strand, and is composed of more slender, much branched, and densely interwoven hyphæ. The first marked internal differentiation is the gelatinisation of a zone of hyphæ in the region that will become part of the inner wall of the peridium; a zone of densely interwoven filaments just within this forms the boundary between the gleba and peridium. The part of the gleba first to become differentiated and to mature first seems to be very variable in the different genera and species investigated.

The peridiola originate in the peripheral portion of the glebal region. They are first distinguished as islets where the ends of undifferentiated filaments converge from all sides around a common point. The wall of the peridiolum is formed by the surrounding of this region by zones of mycelial tissue, the number of zones varying in the different species, as does also the order of the appearance of the peridiola.

As development of the peridiola progresses, the area of converging filaments enlarges by multiplication, and a central space appears filled with slime, probably due to the gelatinisation of filaments of the fundamental tissue. The filaments enlarge at the tip and a palisade-layer is formed, composed of basidia and paraphyses of variable length. At maturity the entire cavity of the peridiolum is densely filled with spores. Where a funiculus is developed (*Cyathus*, *Crucibulum*) it has its origin in somewhat parallel filaments extending from the innermost surface of the peridium to the primordium of the peridiolum. Later, just outside of the peridiolum a region of actively growing filaments appears. These elongate rapidly and soon form a bundle of parallel filaments. Surrounding this are somewhat gelatinised filaments of ground tissue, which form the outer covering of the mature funiculus. In *Nidularia* the wall of the peridiolum remains for some time open at the poles. The epiphragm in *Cyathus* is formed by the peridium being pulled off from over the glebal region and leaving parts of the ungelatinised ground tissue, which forms a thin covering. In *Crucibulum* the epiphragm consists of the undifferentiated primordial tissue covered with branched hairs. The epiphragm finally undergoes gelatinisation.

## *Key.*

| | | |
|---|---|---|
| 1. | Peridiolum single, ejected from the peridium, which splits in a stellate manner ........................ | *Sphærobolus.* |
| | Peridiola several ........................ | 2. |
| 2. | Peridiola free within the peridium ........................ | *Nidularia.* |
| | Peridiola attached to the interior of the peridium by a cord (funiculus) ........................ | 3. |
| 3. | Peridium-wall of two layers; peridiolum attached by a papilla to the funiculus ........................ | *Crucibulum.* |
| | Peridium-wall of three layers; peridiolum umbilicately attached to the funiculus ........................ | *Cyathus.* |

## CXX. CYATHUS Haller.

(Greek *kuathos*, a wine-cup.)

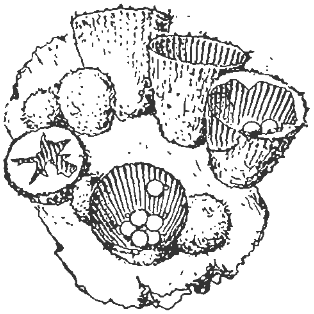

Fig. 116.- *Cyathus striatus*, Hoffm. (Nat. size.)

The fruit-body is cylindrical, then campanulate, with a wall consisting of three distinct, closely connected layers, closed at first with a membranous epiphragm, which finally ruptures and disappears; the numerous peridiola are compressed and umbilicate, and attached to the inner wall of the peridium by a cord (funiculus). There are two British species.

**C. striatus** Hoffm. (2090).—Pe. reddish brown or ferruginous and strigosely hairy externally, obconic or bell-shaped, apex at first incurved and closed in by a pale epiphragm, then opening and showing the lead-coloured, fluted, inner surface; peridiola whitish, subcircular. *Fasciculate on stumps.* C. $\frac{3}{4}\times\frac{1}{4}$.

**C. vernicosus** DC. (2091). Pe. greyish or ochraceous externally, minutely silky, then smooth, campanulate, mouth broadly open, undulate, tapering downwards to a narrow base, lead-coloured or brownish and smooth inside; peridiola blackish or greyish, shining, circular, biconvex, attached to a *white funiculus*. Bare ground, rotten wood, etc. C. $\frac{1}{4}\times\frac{1}{4}$.

## CXXI. CRUCIBULUM Tul.

(Latin *crucibulum*, a crucible.)

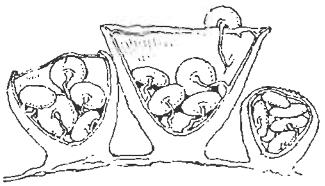

Fig. 117. - Section of *Crucibulum vulgare* Tul. (× 3.)

The fruit-body is globose, then cup-shaped, with a wall consisting of two layers, the outer thick and felt-like, the inner a thin membrane at first extending over the apex as a flat epiphragm, which is finally ruptured; the peridiola are numerous and attached to the outer wall of the peridium by a long cord, which originates from a central depression in a central nipple-like tubercle on the under side of the peridiolum. There is a single British species.

**C. vulgare** Tul. (2092).—Pe. greyish or dirty cinnamon, finally broadly open, minutely tomentose externally, soon becoming smooth, whitish, smooth and shining inside; peridiola pale, circular, *biconvex*. Wood, twigs, etc. C. $\frac{3}{8}\times\frac{1}{4}$.

Young fruit-bodies not infrequently develop on the inside of old peridia which have lost their peridiola.

## CXXII. NIDULARIA.

(Latin *nidulus*, a little nest.)

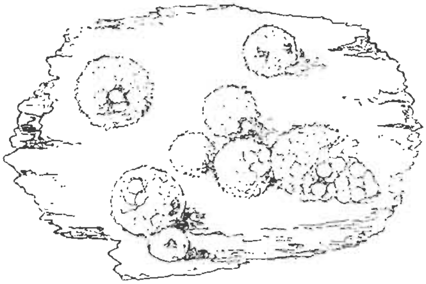

Fig. 118.—*Nidularia pisiformis* Tul. (× ⅓.)

The fruit-body is subglobose and sessile, with a wall consisting of a single membrane, at first closed, then dehiscing irregularly or in a circumscissile manner, and containing numerous peridiola enveloped in mucus, not attached by funiculi at maturity. There are three British species growing on the ground, on wood, and on leaves.

**N. pisiformis** Tul. (2093).—Pe. whitish, then cinnamon or brownish, seated on a broad base, minutely tomentose, *dehiscing in a circumscissile manner*; peridiola brown, subrotund, biconvex, shining. Dead branches. O. $\frac{5}{16}$ in. diam.

## CXXIII. SPHÆROBOLUS Tode.

(Greek *sphaira*, a ball, *bollo*, to throw.)

The fruit-body is globose or subglobose, with an outer wall of three layers which split in a stellate manner and eject the gleba. Growing on wood, leaves, etc. There are three British species.

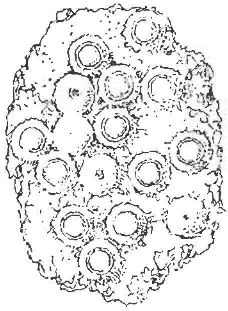

Fig. 119.—*Sphærobolus stellatus* Tode. (× 3.)

**S. stellatus** Tode (2096).—Pe. whitish or pale yellow, globose, then oval, at first immersed in a thick web of white mycelium, tomentose, then smooth, opening above with 6–8 acute teeth; gleba at first whitish and transparent, then brown, broadly elliptical. Crowded on wood, sawdust, etc. C. $\frac{1}{16}$ in. diam.

The outer layer of the peridium is gelatinous, the middle layer pseudoparenchymatous, and the inner layer fibrous; the gleba consists of a peripheral layer of palisade cells and a central fertile portion. At maturity the middle layer of the peridium swells up and the inner layer is extended and finally throws off the gleba, often to a distance of several feet.

## Family 5.—HYMENOGASTRACEÆ.

The Hymenogastraceæ comprise all the Gasteromycetes which develop underground. They are subglobose, fleshy or somewhat leathery, becoming sometimes gelatinous. The peridium is indehiscent, there is no capillitium, and the sporiferous mass is never powdery. The number of spores borne on the basidia is variable; the spores are large. The species are often mistaken for truffles.

**Development.**—In *Hysterangium* the fruit-body arises by the swelling and differentiation of the tip of a rhizomorph, and the columella is continuous with the medulla of the rhizomorph. The fundament of the gleba has its origin at the periphery of the central strand and subsequent growth takes place outwards. This causes the formation of peripheral folds. Intercalary growth and hyphal branching takes place through each fold, resulting in the peridium being pushed outward and in the points between the folds being left behind in the interior of the glebal tissue as the innermost ends of the glebal chambers. The apparent folding in of the peripheral tissue is wholly due to outward growth.

Similar development of the glebal chambers occurs in *Hymenogaster*. In *Rhizopogon* the chambers arise in a different manner. The developing gleba shows areas of dense tissue and others which are much less compact. The former become much more dense and are torn apart by the growth of the fruit-body. In this way spaces arise in the gleba and hyphæ, the ends of which become basidia, grow into them.

*Key.*

| | | |
|---|---|---|
| 1. | Peridium easily separable from the gleba ................. | 2. |
| | Peridium separable with difficulty .......................... | 3. |
| 2. | Sterile base well developed, and giving rise to tramal plates ........................................ | *Hysterangium.* |
| | No sterile base; tramal plates arising from the wall...... | *Octaviania.* |
| 3. | Surface with vein-like mycelial cords ....................... | 4. |
| | Surface smooth ................................................ | 5. |
| 4. | Sterile base well developed, gleba cavities empty ......... | *Melanogaster.* |
| | No sterile base, gleba cavities filled with gelatinous pulp. | *Rhizopogon.* |
| 5. | Sterile base well developed........................................ | *Hymenogaster.* |
| | No sterile base........................................................ | *Hydnangium.* |

## CXXIV. OCTAVIANIA Vitt.

(After V. Ottaviani, an Italian mycologist.)

The fruit-body is globose, oblong, or irregular, with a soft and fibrous wall; the cells of the gleba are empty at first; the tramal cells split and become mucilaginous; there is a distinct sterile base. There are three British species.

**O. asterosperma** Vitt. (2099).—Pe. whitish, then greyish fuliginous, becoming greenish blue when rubbed or exposed to the air, subglobose or irregular, covered with a tomentum which cracks into floccose flattened warts; gleba walls white, becoming greenish blue when rubbed; smell pleasant. Buried twigs etc. R. 1½ in. diam.

## CXXV. MELANOGASTER Corda.

(Greek *melas*, black, *gaster*, the belly—from the black interior.)

The fruit-body is subglobose or elliptical, with no distinct base, and with branched mycelial strands arising from every part of the surface; the wall is fleshy, firm, and not sharply separated from the gleba; the gleba is traversed by sterile veins. There are two British species.

172. **M. variegatus** Tul. (2102). (Latin *variegatus*, of different colours—from the gleba.)

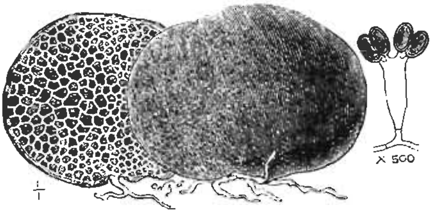


Fig. 120.—*Melanogaster variegatus* Tul. (Nat. size.)

Fruit-body ochraceous or clear yellow, then reddish ferruginous, irregularly globose or nodular oval, adpressedly tomentose and ornamented with a brown, fibrous, cord-like, anastomosing mycelium; gleba fuliginous, then black; tramal plates whitish, then bright orange; taste sweet; smell aromatic, like bitter almonds.

Uncommon. June to November. $2\frac{1}{2}$ in. diam. Edible. More or less exposed above ground during growth, covered with leaves and twigs.

Formerly sold in the markets of Bath under the name of "Red Truffle." The var. *Broomeianus* differs in the tramal plates being dull white or yellowish, never bright yellow or orange; scentless when young. Under beeches and Lombardy poplars. F. 2 in. diam.

## CXXVI. HYDNANGIUM Wallr.

(Greek *hudnon*, a truffle, *aggeion*, a vessel—from the tuberous form.)

The fruit-body is oblong or roundish, and the wall is not separable from the gleba, of which the cells are minute and at first empty. There are two British species.

**H. carotæcolor** B. & Br. (2104).—Pe. pale orange-red or carrot-colour, rootless, rugulose, subtomentose; gleba orange, cells minute, irregular. Woods etc. O. 1 in. diam.

The fungus stains paper lemon-yellow.

## CXXVII. HYSTERANGIUM Vitt.

(Greek *hustera*, the womb, *aggeion*, a vessel—from the shape.)

The fruit-body is globose and the wall separates from the gleba at maturity; the gleba is cartilaginous or mucilaginous, and the cells are at first empty. There are two British species.

**H. nephriticum** Berk. (2106).—Pe. white, arising from a much-branched white mycelium, tomentose, rather thick, elastic; gleba pinkish, then pale blue-grey, becoming greenish, cells minute, radiating from the base, much contracting when dry; sometimes confluent; smell slight, then disagreeable. Underground in woods. O. $\frac{3}{4}$ in. diam.

## CXXVIII. **RHIZOPOGON** Tul.

(Greek *rhiza*, a root, *pogon*, a beard.)

The fruit-body is globose or oblong and covered on the surface with mycelial strands; the gleba-cells are empty at first. There are two British species.

**R. rubescens** Tul. (2108).—Pe. white, becoming reddish when exposed to the air, then yellow or olive, silky, covered with numerous strands of mycelium, which become reddish when touched; gleba yellowish, then brownish, cells small, irregular. Fir woods. O. 1½ in. diam. Edible.

**R. luteolus** Fr. Pe. whitish, becoming dirty yellow, then olive-brown, thick, subcoriaceous, clothed with numerous free or adnate mycelial strands; gleba olivaceous, tramal plates whitish, cells minute, rounded; smell weak, then offensive. Fir woods. F. 1¾ in. diam. Edible.

## CXXIX. **HYMENOGASTER** Vitt.

(Greek *humen*, a membrane, *gaster*, a belly—from the usually thin membrane.)

The fruit-body is globose, with a simple and homogeneous wall; the cells of the gleba are empty at first; there is a well-developed sterile base.

**H. olivaceus** Vitt. (2118). Pe. whitish, becoming rufescent when touched, angularly globose, silky; gleba whitish, then buff, finally rufous-olive. Underground in woods. O. 1¼ in. diam.

# Class II. ASCOMYCETES.

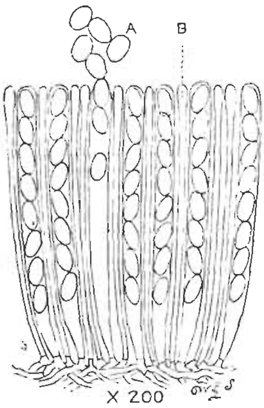


Fig. 121. Asci and paraphyses (B): ascospores (A). (× 200.)

The distinguishing character of the Ascomycetes is the ascus, usually clavate or cylindrical in shape and containing typically eight spores (fig. 1, B). The ascospores in the different genera are of various shapes, colours, and septation. Ascomycetes are subdivided on the character of the fruit-bodies and the manner in which the asci are borne on them. The orders represented in the models are Discomycetes, Pyrenomycetes, and Tuberaceæ. The first have the hymenium exposed, usually lining the interior of a cup-shaped fruit-body; the second have the hymenium enclosed in a flask-shaped fruit-body, whereas in the third the asci are arranged in groups in an indehiscent subterranean fruit-body. Where a hymenium is present it shows a serried arrangement of clavate asci with intermingled much more slender structures known as *paraphyses*, which probably act as spacing agents (fig. 121, B).

In sun-light the larger species may often be seen to give off spores in clouds. This puffing, which is sometimes audible, can also be brought about by touching the hymenium.

The use of the microscope is essential for the correct determination of Ascomycetes, many of which are microscopic in size. The nomenclature as given in the Exhibition Gallery has been retained.

**Cytology.**—The young ascus is uninucleate, and by two successive divisions eight nuclei arise. These become beaked with a centrosome at the tip emitting rays which bend backwards and cut out the body of the spore, the cell-wall being formed by fusion of the astral rays. Well-marked sexual organs occur in certain genera, e. g., *Pyronema*, in others the male organ is wanting, e. g. *Sordaria*, while in possibly most of the genera no differentiated sexual apparatus is to be seen. Whether nuclear fusion occurs in the ascogonium (female organ) between male and female nucleus, or between two female nuclei when an antheridium (male organ) is absent, is at present a matter of controversy. The nuclei pass from the ascogonium into hyphæ, which are to bear at their ends the asci. The ascogenous hypha usually bends over at its tip and cuts off a binucleate, penultimate cell. The two nuclei fuse, and thus arises the definitive nucleus of the young ascus.

## Order I. DISCOMYCETES.

In this order the fruit-body is generally in the form of a cup, which is closed at first, but soon opens and expands with growth, often finally becoming convex, and is either sessile or borne on a stalk. It is almost always simple, but may be compound as in *Morchella*. The hymenium is spread over the upper surface of the cup as a distinct membrane. The mode by which the ascus opens, whether by a small lid or by a pore, together with associated characters, has been made the basis of modern classification. The species treated here are those of which there are models and those which are figured on the stands.

### CXXX. **MORCHELLA** Linn.

(German *Morchel*, a morel.)

The fruit-body is stalked, with a clavate, globose, or conical cap, which is deeply folded or angular pitted, and bears the hymenium in the hollows, the ribs being sterile. All the species of this genus are edible.

i. Pileus adnate to the stem throughout its length.

173. **M. esculenta** Linn. (1). (Latin *esculentus*, good to eat.) Morel.

Cap typically ochraceous yellow, but sometimes light ochre, brown, yellowish grey, or greyish brown, usually globose, sometimes oval or somewhat conical, with firm anastomosing ribs which form deep, wide, expanded, irregularly arranged pits with radiating folds; stem whitish, often yellowish or reddish when old, stout, thickened and grooved at the base, smooth or broadly furrowed, hollow, fragile, mealy; flesh waxy, brittle; taste and smell pleasant.

Clearings in woods etc. Not uncommon. Spring. Edible. P. $3\frac{1}{2} \times 4$; S. $2\frac{1}{2} \times 1\frac{1}{2}$.

Morels are used chiefly for flavouring soups, sauces, and gravies; also for ketchup. They are readily dried on strings, but should not touch, as this favours the growth of moulds.

Many attempts have been made to grow this species artificially, but without any measure of success. Pure cultures of mycelium may be readily obtained either from spores or from portions of tissue. The spawn is brownish in colour and readily forms sclerotioid bodies; conidia (*Costantinella*) are produced in a dry atmosphere.

Sometimes, owing to the attack of the parasitic mould *Mycogone cervina*, the cap of the growing fungus appears as if dusted with snuff.

**M. crassipes** Pers. (4).—Differs from 1 in its greyish-tawny oval-conical P. and in its more furfuraceous S. being larger than the P. and much swollen at the base. Woods. R. P. $4\frac{1}{2} \times 3\frac{1}{2}$; S. $5\frac{1}{2} \times 3$. Edible.

**M. Smithiana** Cooke (5).—Differs from 4 in the ribs of the tawny subglobose P. often being appendiculate with short prolongations and in the tomentose S. R. P. $6 \times 6\frac{1}{2}$; S. $6\frac{1}{2} \times 3\frac{1}{2}$. Edible.

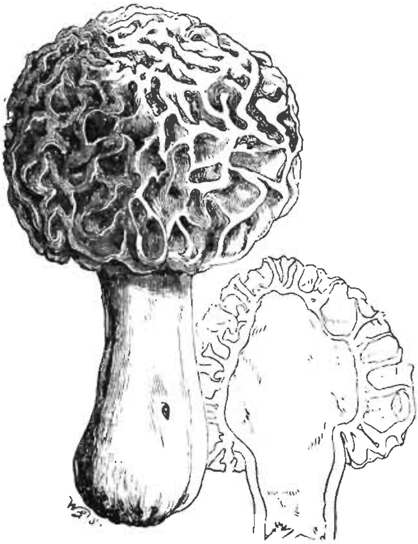

Fig. 122.—*Morchella esculenta* Linn. ($\times \frac{1}{2}$.)

ii. Base of pileus separated from the stem by a groove.

174. **M. conica** Pers. (3). (Latin *conicus*, conical.)

Cap tawny ochraceous or olivaceous tawny, conical, with the primary ribs longitudinal and often extending the whole length of the cap, somewhat anastomosing, soon becoming blackish, secondary ribs forming transverse folds; pits elongate, narrow, subquadrilateral, plicato-lacunose; stem pale tawny, whitish, greyish, or yellowish, equal or somewhat attenuated at the base, hollow, covered with furfuraceous squamules, grooved above and below.

Grassy places under trees and in woods. Uncommon. Spring. P. $2\frac{1}{2} \times 1\frac{1}{2}$; S. $1 \times \frac{1}{2}$. Edible.

**M. elata** Fr. (2).—Differs from 3 in the conical P. being pointed above, in the furfuraceous S., and the smaller size. P. olivaceous tawny, with black longitudinal primary ribs extending from tip to base, secondary ribs wavy; S. somewhat elongated, grooved, especially above. Fir woods. O. P. $2\frac{3}{4} \times 1\frac{3}{4}$; S. $1\frac{1}{2} \times 1$. Edible.

iii. Lower half of pileus free from the stem (*Mitrophora*).

175. **M. semilibera** DC. (8) (*M. rimosipes* DC., 7). (Latin *semi*, half, *liber*, free.)

Cap olivaceous tawny, broadly conical, somewhat acuminate or obtuse, with the primary ribs blackish, more or less elongated and anastomosing, forming oblong pits which vary—brown, tawny, or ochraceous; stem whitish or pale ochraceous, furfuraceous, attached to the interior of the cap about the middle, sometimes a little thickened at the base, even when young, grooved when old, hollow.

On the ground in woods. Frequent. Spring. P. 1×¾; S. 3×¾. Edible.

The young stage with even stem is *M. rimosipes* DC.

**M. gigas** Lév. (6).—Differs from 8 in its large size, and in its stout, elongated, bulbous S. being coated with rust-coloured squamules. On sandy ground. R. P. 3×2; S. 5×2½. Edible.

## CXXXI. GYROMITRA Fr.

(Greek *gyros*, round, *mitra*, a turban.)

*Gyromitra* differs from *Morchella* in having the hymenium covering brain-like ribs or folds.

176. **G. esculenta** Pers. (9). (Latin *esculentus*, good to eat.)

Fig. 123.—*Gyromitra esculenta* Pers. (× ½.)

Cap tawny, then chestnut or coffee-brown, often with a violet sheen, inflated, irregularly undulated, gyroso-rugose, brain-like, hollow, thin, lobed, whitish and smooth below, here and there attached to the stem; stem whitish, often tinted ochraceous, reddish, or purple, grooved at the base and at the apex, where it is sometimes bifurcate, hollow above, stuffed below, brittle.

Sandy pine woods. Uncommon. Spring. 3×3×1½. Suspicious.

This species, in spite of its specific name, must be regarded with suspicion. It should never be eaten raw, and the water in which it is cooked should not be used.

**G. gigas** Cooke (11).- Differs from 9 in the ochre to cinnamon P. with thick broad crisped lobes or folds, the very short and thick S.. and the large size. On the ground. R. 5×2×2. Edible.

**G. Phillipsii** Mass. (10).- Differs from 11 in the lighter-coloured cap with more pendent lobes, and in attaining a much larger size: somewhat resembling *Sparassis crispa* (p. 150). Under beech trees. R. 12 in. diam. Edible.

## CXXXII. HELVELLA Fr.

(A name used by Cicero, probably for a vegetable.)

The fruit-body is stipitate and pileate; the cap is supported at the centre, irregular, thin, with drooping lobes or sometimes saddle-

shaped, sometimes crisped and irregularly sinuous; the even hymenium is borne on the upper surface; the stem is elongated and often ribbed or lacunose. All species are edible, but should not be eaten raw.

i. Pileus freely lobed, stem relatively thick.

177. **H. crispa** Fr. (12). (Latin *crispus*, wrinkled.)

Fig. 124.—*Helvella crispa* Fr. (Nat. size.)

Cap white, tinted pink or ochraceous above and ochraceous yellow below, thin, trilobed, with the lobes at first more or less attached to the stem, then free, undulate; stem white, very firm, somewhat swollen below, deeply grooved, lacunose, appearing almost as if formed of somewhat anastomosing longitudinal ribs; fragile.

Amongst grass, usually in woods. Not uncommon. Autumn. 2×4×1½. Edible.

**H. lacunosa** Afz. (13).—Differs from 12 in the black or blackish P., paler below, and in the dark cinereous S. Woods. F. 1½×3×½. Edible.

**H. sulcata** Afz. (14).—Differs from 13 in its generally smaller size and in the S. not being swollen at the base. Woods. O. ¾×1½×½. Edible.

**H. fusca** Gill. (18).—Is distinguished from 13 by the dingy ochraceous-brown colour of the P., which is strongly veined below, and by the white S. Meadows. O. 2×2¾×½. Edible.

**H. subcostata** Cooke (15).—Differs from 18 in the larger, undulated, free P. and stout grooved S. On the ground. R. 2½×2½×½.

**H. monachella** Fr. (17).—P. chestnut-brown above, white below, bilobed, lobes reflexed, undulate, more or less adnate to the white, hollow, smooth S. Sandy woods. R. 1¾×2½×½.

ii. Pileus entire or hardly lobed, stem relatively slender (*Leptopodia*).

178. **H. elastica** Bull. (20). (Greek *elastikos*, elastic.)

Cap white, pinkish grey, or brownish, thin, undulate, with two reflexed lobes, paler and glabrous below; stem concolorous or paler, cylindrical, then often compressed, somewhat slender, subfurfuraceous at the apex, a little thickened at the base, longitudinally grooved.

Moist places in woods. Not uncommon. Summer and autumn. 1½×2½×¼. Edible.

**H. guepinioides** Berk. & Cooke (19).—Differs from 20 in the ochraceous P. and white or yellowish even S. On the ground. R. 2×3×¼.

**H. infula** Schaeff. (16).—P. reddish brown or cinnamon, whitish and villose below, hooded, with two to four drooping lobes strongly adherent to the sides of the S., finally undulate; S. paler or tinged reddish, even, white, mealy. Woods. R. 3½×4×¾. Edible.

**H. atra** König (21).—P. fuliginous or purple-black, with two drooping lobes, margin somewhat incurved, grey and smooth below; S. black or blackish, whitish or greyish towards the swollen base, villoso-furfuraceous. Moist woods. O. 1×2½×½.

**H. pulla** Holms. (22).—Differs from 21 in the sooty-brown hymenium and cream-coloured, mealy, hollow S. Moist woods. R. $1 \times 2\frac{1}{2} \times \frac{1}{4}$.

**H. ephippium** Lév. (23).—Differs from 21 in the bistre hymenium and in the cinereous villose under surface and S. Woods. F. $1\frac{1}{4} \times 1\frac{1}{2} \times \frac{1}{8}$.

## CXXXIII. VERPA Swartz.

(Latin *verpa*, the membranum virile.)

The fruit-body is erect, stipitate, and regularly pileate; the cap is supported in the centre, conical, and equally deflexed all round with the margin pressed to the stem but free; the hymenium is superior and even or wrinkled.

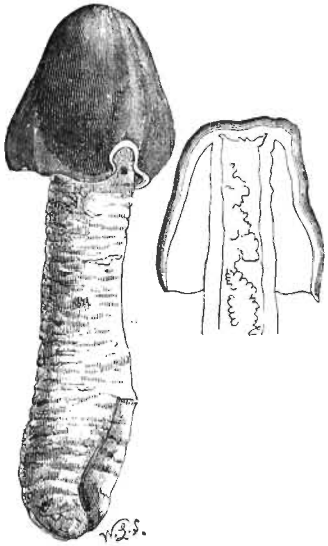

Fig. 125.—*Verpa digitaliformis* Pers. (Nat. size.)

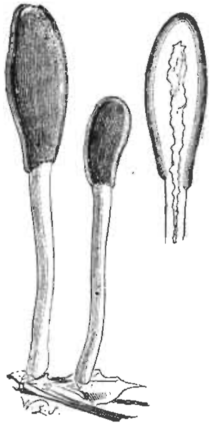

Fig. 126.—*Mitrula paludosa* Fr. (Nat size.)

179. **V. conica** Swartz (26). (Latin *conicus*, conical.)

Cap brown above, yellow below, campanulate, fleshy, nearly even, slightly sinuate at the margin; stem concolorous, subcylindrical, smooth, stuffed, then fistulose; brittle.

Heaths. Rare. Spring. $1 \times 2 \times \frac{1}{2}$.

**V. digitaliformis** Pers. (24).—Differs from 26 in the bistre-brown, conical, rugulose P., white or greyish and minutely tomentose below, and in the white stouter S. tinged rufous with transverse rufous spots. Hedge-banks etc. R. $1 \times 3 \times 1$.

**V. rufipes** Phill. (25).—Differs from 24 in the margin of the dark umber P. standing well away from the rufous squamulose S. Hedge-banks. R. $1 \times 1\frac{1}{2} \times \frac{3}{8}$.

## CXXXIV. MITRULA Fr.

(Latin *mitrula*, a small turban.)

The fruit-body is fleshy, erect, and stipitate, with a subglobose, ovate or clavate, glabrous, fertile head, which is usually sharply delimited from the stem and often slightly free from it below.

i. Pileus separated from stem by a groove.

180. **M. cucullata** Fr. (27). (Latin *cucullus*, a hood.)
Head cream to yellowish ochraceous or ferruginous, elliptical, ovate or obovate, rounded above, even, distinct from the stem below and separated from it slightly at the base; stem yellowish brown above, darker below, slender, solid, usually flexuose, equal or tapering slightly upwards, pruinose, the base often surrounded by a yellowish-brown tomentum. All parts of the fungus become darker in drying. Gregarious on decaying pine-leaves. Uncommon. Autumn. $\frac{1}{4} \times 2$.

181. **M. paludosa** Fr. (28). (Latin *paludosus*, marshy.)
Head clear orange-yellow, globose, ovate or elliptical, often somewhat compressed, apex rounded, obtuse, rarely bifid, at first solid, becoming vesiculose, hollow to inflated when old, even or with slight longitudinal furrows especially below, sharply differentiated from the stem by a narrow groove; stem white, sometimes with a pinkish tinge, silky, slender, straight or flexuose, becoming hollow, smooth, translucent and viscid when moist, often coloured at the base with diatoms or organic debris; soft and somewhat tremellose.

Gregarious on decaying leaves etc. in marshes and pools. Common. Spring to autumn. $\frac{1}{2} \times 3$.

**M. alba** W. G. Sm. (29). Differs from 28 in being entirely white: head subglobose. Amongst submerged leaves. R. $\frac{3}{8} \times 1\frac{1}{2}$.

ii. Pileus not separated from stem by a groove (*Microglossum*).

**M. viride** Karst. (30).—Is distinguished by its olive-buff or olive ochraceous head and pale pea-green squamulose S. Amongst moss etc. in woods. F. $\frac{1}{4} \times 3$.

**M. olivacea** Sacc. (31).—Is distinguished by its greenish-brown head, often tinted yellow or buff, and its shiny yellowish-buff or olivaceous-brown S. Short grass. O. $\frac{1}{4} \times 2$.

## CXXXV. SPATHULARIA Pers.

(Greek *spathe*, a spatula.)

The fruit-body is erect, fleshy, and stipitate, the fertile portion spathulate, much compressed, fan-shaped and decurrent on opposite sides of the stem, from which it is sharply delimited.

182. **S. flavida** Pers. (32). (Latin *flavidus*, light yellowish.)
Head yellow, even, undulate or radiately rugose, sometimes contorted, clavate or almost capitate; stem white or tinged yellow,

slightly brownish at the base, smooth or farinose, hollow, round or somewhat compressed, tapering upwards, often swollen or bulbous below, springing from a pallid or yellowish mycelium; flesh white: usually becoming yellowish brown when dry.

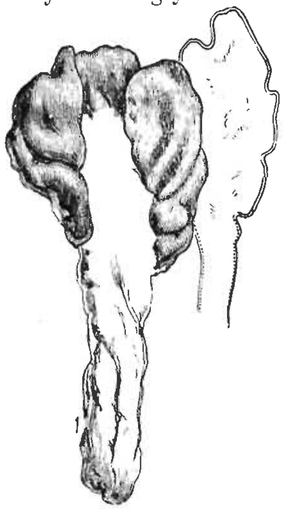

Fig. 127.—*Spathularia flavida*, Pers. (Nat. size.)

Gregarious on moss and leaves in damp coniferous woods. Not common. Summer and autumn. 1×5. Edible.

## CXXXVI. GEOGLOSSUM Pers.

(Greek *ge*, the earth, *glossa*, a tongue.)

The fruit-body is black or blackish, fleshy, erect, clavate and stipitate; spores brown.

**G. hirsutum** Pers. (35) (*Trichoglossum*).—Is distinguished by the minutely hairy, black hymenium and S.: the fertile portion varies from subrotund to lanceolate. Cæspitose in damp pastures. F. ½×3.

**G. difforme** Fr. (36).—Re. black, evenly clavate, strongly compressed, viscid; spores 15-septate. Cæspitose in grass. O. ½×4.

**G. glutinosum** Pers. (39).—Differs from 36 in the terete brown S. and rather elliptical, somewhat compressed, darker, fertile head: spores 0–7-septate. Grass. O. ½×2.

**G. viscosum** Pers. (38).—Is probably only a form of 36, differing in its head not being compressed and in being more viscid. Pastures. F. ½×3.

**G. glabrum** Pers. (37).—Re. brownish black, clavate, compressed, not viscid, but clammy. Pastures etc. F. ½×2.

## CXXXVII. LEPTOGLOSSUM Cooke.

(Greek *leptos*, fine, *glossa*, a tongue.)

*Leptoglossum* differs from *Geoglossum* in having colourless spores.

**L. microsporum** Sacc. (33).—Re. black, rather slender, narrowly clavate: S. minutely squamulose. Scorched ground. R. ⅓×2½.

**L. tremellosum** Sacc. (34).—Is probably only a form of 33, being somewhat tremellose when moist and having a smooth S. On the ground. O. ⅜×3.

## CXXXVIII. CUDONIA Fr.

(Latin *cudo*, a helmet made of raw skin.)

The fruit-body is stipitate, erect, fleshy-leathery, the fertile portion pileate, convex, and peltate, with the margin acute and incurved towards the stem; the hymenium is borne on the upper surface.

**C. circinnans** Fr. (40). P. usually cream-buff with a faint rosy tinge, rather thin, even or undulate: S. darker than the P., often striate, especially above, the striæ being prolonged as radiating veins on the lower side of the P., somewhat farinaceous; often growing in rings. Coniferous woods. O. $\frac{3}{4}\times2\times\frac{1}{4}$.

## CXXXIX. LEOTIA Hill.

(Greek *leiotes*, smoothness.)

The fruit-body is erect, stipitate, and irregularly pileate; the cap is orbicular, revolute at the margin, and supported at the centre; the hymenium is undulate or even; the substance is fleshy, soft, and somewhat tremellose.

183. **L. lubrica** Pers. (41). (Latin *lubricus*, shining.)

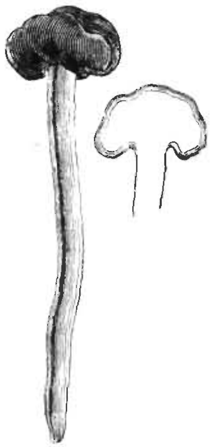

Fig. 128.—*Leotia lubrica* Pers. (Nat. size.)

Cap ochraceous yellow or brownish yellow, often with a greenish or olive tint, irregularly globular, convex, or slightly depressed, often irregularly furrowed with recurved, wrinkled, or nodulose margin; stem yellow, sometimes with innate green granules, cylindrical or somewhat compressed, usually slightly tapering upwards, minutely squamulose, hollow, and stuffed with a gelatinous pith, adjacent ones often coalescing below; slimy.

On the ground in woods. Common. Summer and autumn. $\frac{1}{2}\times2\times\frac{1}{4}$. Edible.

*Very variable in form*, consistency and colour depending upon the situation of the plant and its substratum: swollen and soft, watery gelatinous, or tremellose in rainy weather, firmer and often cartilaginous when dry.

**L. chlorocephala** Schwein. (42). Differs from 41 in its firm, clammy, less translucent substance, in the dark green colour of every part and in the furfuraceous S. Amongst moss in woods. R. $\frac{1}{2}\times4\times\frac{1}{4}$.

## CXL. RHIZINA Fr.

(Greek *rhiza*, a root—from the fibrils on the under surface.)

The fruit-body is sessile, expanded from the first, inflated, repand, concave below, and furnished with root-like fibrils; the hymenium occupies the upper surface.

**R. undulata** Fr. (43).—Chestnut-brown, drying blackish brown, at first with yellowish-white margin, plane, then convex, undulate and irregular in outline, paler below and furnished with numerous stout fibrils, which attach the fungus to the ground. Coniferous woods. C. 3 in. diam.

The mycelium is parasitic on the roots of conifers.

**R. lævigata** Fr. (44).—Differs from 43 only in its smaller size, more or less orbicular shape, and convex, even surface. Coniferous woods. R. 1 in. diam.

## CXLI. GEOPYXIS Pers.

(Greek *ge*, earth, Latin *pyxis*, a small box.)

The fruit-body is large and somewhat fleshy, with a usually long even stem, which is often tapering at the base and rooting.

**G. rapulum** Bull. (46).—Tawny ferruginous, infundibuliform: S. *rather long*, tortuous, filiform, fibrillose at the base, arising from a black fragile stroma which surrounds the rhizomes of *Polygonatum multiflorum* etc. O. 1×1.

**G. carnea** Cooke & Phill. (47).—Flesh coloured, cyathiform, margin crenate; S. rather long, expanding into the decurrently wrinkled base of the cup. On the *ground*. R. 1×1.

**G. petaloidea** Cooke & Phill. (48).—Disc purple-brown, rugose, subumbilicate, margin deflexed, *externally fuliginous* brown, pruinose to verrucose, cupulate to expanded, lobate: S. somewhat slender, tapering downwards from the rugose base of the cup, deeply rooting, floccose. *Amongst leaf-mould*. R. 1×1.

**G. ammophila** Dur. & Mont. (50).—Disc brown or brownish, with margin torn into wide triangular teeth, externally paler, turbinate; S. *fragile, elongated*, rooting, sometimes branched. In dry sand usually amongst *Elymus*. F. 2×2.

**G. insolita** Cooke (51).—Disc ochraceous white, margin acute, externally whitish, downy when young, cyathiform; S. thick, attenuated below. Amongst mould in fig-house. R. ¼×1.

**G. carbonaria** Alb. & Schwein. (52).—Disc brownish tan with whitish, mealy, crenulate margin, externally somewhat paler, cupulate to campanulate; S. slender, of *variable length*. *On burnt ground*. C. ¼×½.

**G. muralis** Sow. (53).—Disc light ochre, externally whitish tomentose, cyathiform, then expanded; S. *short, rather slender*, enlarging upwards into the thick fleshy base of the cup. On clay walls. O. ½×½.

**G. cupularis** Linn. (54).—Disc grey, *tinged yellow, with dentato-crenulate* margin, externally ochraceous grey, coarsely scurfy, cupuliform, subsessile. Damp places. C. 1×½.

## CXLII. ACETABULA Fuckel.

(Latin *acetabulum*, a vinegar-cup.)

The fruit-body is cup-shaped, fleshy, large, with a short, thick, *sulcate* stem.

184. **A. vulgaris** *Fr.* (Latin *vulgaris*, common.)

Disc greyish, then umber-brown, even, externally paler, veined, *minutely scurfy*, cyathiform with the mouth somewhat constricted; stem whitish, short, thick, fistulose, with parallel or anastomosing ribs, which extend to the margin of the cup as branching veins.

In damp places. Not uncommon. Spring. 2×2½. Edible.

**A. leucomelas** Boud. (*Geopyxis Perceralii* Berk. & Cooke, 49).—Differs from No. 184 in the ribs of the stem not extending to the exterior of the cup as veins and in the whitish exterior. On the ground in woods. O. 2×2½.

## CXLIII. PEZIZA Dill.

(Greek *pezis*, a name used by Theophrastus to denote certain fungi—? *Lycoperdon Bovista*.)

The fruit-body is closed at first, then expanding until cup-shaped, disc-shaped, or sometimes plane or even convex, sessile or sometimes narrowed below into a short stem-like base, fleshy and brittle; the hymenium is even, nodulose, or veined, the exterior warted, scurfy, or subglabrous. *Probably all the larger species are edible.*

185. **P. aurantia** Oed. (55). (Latin *aurantius*, orange-coloured.)
Disc shining reddish orange, exterior paler, often whitish in dry weather, subpruinose, cup-shaped, almost sessile, often irregularly developed, more or less repand, sometimes undulate by pressure, thin.
Cæspitose or single. On the ground. Common. Summer and autumn. 4 in. diam. Edible.

**P. fibrillosa** Curr. (58). - Differs from 55 in being clothed externally with *dingy-white downy fibrils which form a rather dense tomentose margin to the cup*. On the ground. R. 1 in. diam.

**P. leuculenta** Cooke (59).– Resembles 58 in external appearance, but differs in microscopic characters. On the ground. R. 1 in. diam.

**P. luteonitens** B. & Br. (56).- -Disc golden yellow, finally irregular and somewhat flexuose, externally paler and slightly pubescent. On the ground. R. ¾ in. diam.

**P. umbrina** Boud. (57).- Cup fuliginous, substipitate, split, with the sides irregular; hymenium darker and a little olivaceous, externally brown-cinnamon, and somewhat furfuraceous; S. with ochraceous mycelium; cæspitose. Woods. 2 in. diam.

186. **P. cochleata** Bull. (Latin *cochleatus*, spiral-formed.)
Disc fulvous to deep brown, externally dingy ochraceous to white, furfuraceous, globose, then expanded, becoming repand with involute margin, sessile, usually split laterally to the tomentose base, variously contorted and plicate.
On the ground. Common. Summer and autumn. 3 in. diam. Edible.

**P. isabellina** W. G. Sm. (60). - Disc reddish tawny, externally greyish white, with reddish tint when moist, glabrous, cup-shaped, then somewhat undulate, sessile. On decayed wood. R. 2 in. diam.

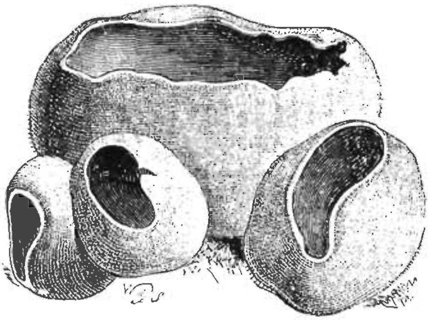

Fig. 129.– *Peziza vesiculosa* Bull. (Nat. size.)

187. **P. vesiculosa** Bull. (*Latin vesiculosus, full of* bladders.)
Disc pallid, yellowish or whitish, with a slight ferruginous tinge, uneven, externally white, whitish, or tinged bistre, coarsely granular, *globose at first with a small apical opening* which gradually increases as the cup becomes irregular and flexuous, campanulate, vesiculose, then repand with an incurved notched margin, sessile or subsessile, fleshy, fragile, transparent, the outer layer of the thickened base often separating.
Generally cæspitose. Gardens, manure-heaps, rotten leaves, etc. Common. Spring to autumn. 2 in. diam.

188. **P. cerea** Sow. (61). (Latin *cereus*, like wax.)
Disc waxy-yellow, darker and brownish when old, externally whitish, yellowish white, or slightly bistre when old, turbinate, then cup-shaped with somewhat sinuate margin, with a short, whitish, furfuraceous, villose, stem-like base, very fragile, waxy.
Generally cæspitose. Among leaves, on tan, etc. Common. Spring. 2 in. diam.

**P. alutacea** Pers. (62).—Disc brownish tawny, externally paler or whitish, somewhat furfuraceous, cochleate, sessile or subsessile, with the base sometimes ending in a small white, tomentose root. Woods. O. 2 in. diam.

**P. grandis** Pers. (63).—Disc ochraceous, often tinted olivaceous, externally olivaceous brown, furfuraceous, usually wavy and more or less plicate, often split down one side to the base with the margin inrolled; S. grooved and white tomentose, fixed to the soil by an abundant ferruginous-yellow mycelium. On leaves. O. 3 in. diam.

**P. ochracea** Boud. (64).—Disc ochraceous, externally paler and furfuraceous, cup-shaped, subflexuous, margin generally remaining incurved; cæspitose. Frondose woods. R. 2 in. diam.

**P. linteicola** Phill. & Plowr. (65).—Disc fulvous, externally farinose, margin crenate, cupulate, or cochleate, with the edges involute, arising from a white creeping mycelium. On damp rotting linen cloth. R. $\frac{1}{4}$ in. diam.

## CXLIV. OTIDEA Pers.

(Greek *otion*, a little ear.)

The fruit-body is subsessile, dimidiately elongated or obliquely contorted, becoming incised on the one side, externally pruinose.

189. **O. leporina** Batsch (Latin *leporinus*, belonging to a hare.) Disc subferruginous or cinnamon, even or rarely wrinkled, externally slighter paler, farinose, substipitate, obliquely cup- or ear-shaped, margin thin, wavy, inrolled, divided on one side to the base, fleshy, tough, base stem-like, thick, short, lacunose; often cæspitose.
Among dead leaves in woods. Autumn. O. $3 \times 2$.

## CXLV. SARCOSCYPHA Fr.

(Greek *sarx*, flesh, *skuphos*, a cup.)

The fruit-body is large, fleshy, stipitate, with a tomentose or hairy exterior.

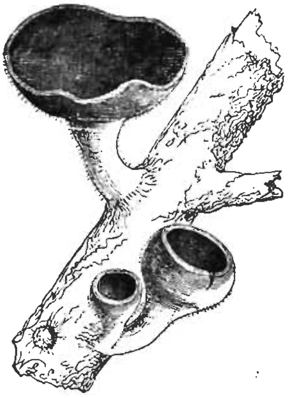

Fig. 130.—*Sarcoscypha coccinea* Jacq. (Nat. size.)

190. **S. coccinea** Jacq. (Latin *coccineus*, scarlet.)
Disc brilliant scarlet or carmine, even, margin yellowish and finely denticulate, externally white or pinkish, clothed with a dense, adpressed tomentum, often somewhat rivulose, globose and closed at first, then funnel-shaped, and finally somewhat flattened; stem cylindrical, thick, hairy at the base, mostly immersed in the ground, usually short, but elongated and curved when attached to the underside of a branch.
On fallen sticks, especially hazel. Spring. C. $1\frac{1}{2} \times \frac{3}{4}$.

Occasionally wholly white. Often appearing through frozen ground, even when lightly covered with snow. In several parts of the country the fungus growing on moss-covered branches is sold as a table decoration.

## CXLVI. MACROPODIA Fuckel.

(Greek *makros*, large, *pous*, a foot.)

The fruit-body is fleshy, stipitate, externally tomentoso-flocculose, with a dark-coloured disc.

191. **M. macropus** Pers.

Disc blackish grey, externally paler, becoming whitish when dry, covered with small, irregular, villose warts, subglobose with incurved margin at first, then cup-shaped with the margin somewhat undulate; stem grey or slightly ochraceous, paler and often grooved or lacunose below, attenuated upwards.

On the ground in shady woods. Summer and autumn. Not uncommon. O. 2 × 3.

## CXLVII. PLECTANIA Fuckel.

(Greek *plektane*, a coil.)

The fruit-body is cup-shaped, shortly stipitate, fleshy or thin, fuscous, flocculose externally, and with a black strigose or fibrous rooting-base.

192. **P. melastoma** Sow. (Greek *melas*, black, *stoma*, a mouth.)

Disc deep black, globose at first, then cup-shaped or irregular, margin covered with short fuliginous hairs, dusted with orange-red granules, crenulate or coarsely notched, externally brownish black, pubescent, often somewhat grooved; stem very short, covered with black fibrils and rooting by very long, coarse, flexuose, black filaments or hairs; fleshy, very cartilaginous when dry.

On rotten sticks etc. Frequent. Spring. 1 in. diam.

## CXLVIII. HYMENOSCYPHA Fr.

(Greek *humen*, membrane, *skuphos*, a cup.)

The fruit-body is cup-shaped with a slender stem.

193. **H. firma** Phill. (Latin *firmus*, firm.)

Disc olivaceous tawny, at first cupulate, then infundibuliform, and finally expanded, with the margin repand, externally somewhat fibrillose or squamulose; stem brown, blackish and velvety at the base, more or less elongate, attenuated downwards; leathery and pliant when fresh, hard when dry.

On decaying oak branches. Common. Autumn. ½ × 2.

## CXLIX. HELOTIUM Fr.

(Greek *helos*, a nail.)

The fruit-body is sessile or slightly stalked, the disc plane or convex, waxy, and naked.

194. **H. virgultorum** Fr. (Latin *virgultum*, a twig.)

Disc yellow, often tinged with red, at length rufous, externally paler and glabrous, at first subglobose and closed, then expanding and becoming flat or convex, with an entire margin; stem paler, cylindrical, subflexuose; tough.

On dead branches. Common. Autumn. $\frac{1}{6} \times \frac{1}{3}$.

195. **H. calyculus** Sow. (Greek *kalux*, the cup of a flower.)

Disc clear yellowish brown, closed at first, then expanding until slightly concave or quite plane, externally sometimes a little paler, glabrous, margin elevated or expanded, incurved when dry; stem brown, glabrous, rather stout, enlarging upwards into the base of the disc; rather fleshy and firm.

On decorticated wood and branches. Uncommon. Autumn. $\frac{1}{8} \times \frac{1}{8}$.

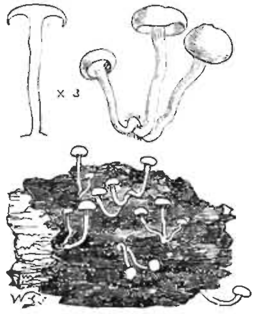

Fig. 131.—*Helotium aciculare* Pers. (Nat. size and ×3.)

196. **H. aciculare** Pers. (*Cudoniella*). (Latin *acicula*, a small pin.)

White, fragile, and waxy. Disc at first plane, with a slight depression in the centre, then convex, the margin sometimes undulating, externally granulose; stem cylindrical, slender, straight or bent, occasionally branched; the whole fungus frequently becomes slightly brownish, with the stem discoloured.

On decaying stumps. Common. Autumn. 1 in. high.

## CL. BULGARIA Fr.

(Latin *bulga*, a leathern bag.)

The fruit-body is gelatinous, substipitate or sessile, glabrous, urceolate at first, the hymenium becoming plane, then convex, and finally subundulate; the spores are dark brown.

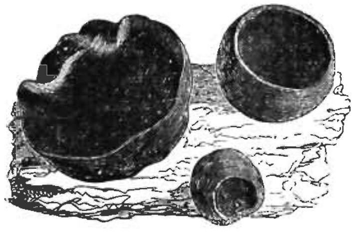

Fig. 132.— *Bulgaria inquinans* Fr. (Nat. size.)

197. **B. inquinans** Fr. (Latin *inquinans*, staining.)

Fruit-body externally umber-brown, wrinkled and scurfy, the disc black and shining, gregarious or cæspitose, erumpent, at first more or less clavate and closed, then turbinate and narrowed into a short stem-like base, mostly buried in the substratum; flesh brown.

On old trunks, especially beech. Common. $1\frac{1}{2}$ in. diam.

The fungus looks and feels like black india-rubber. The spores are ejected in such abundance that the surrounding bark is covered with a black sooty deposit. Sometimes the ascus contains eight blackish-brown spores, sometimes four coloured and four colourless spores, and sometimes four dark spores only. The last two conditions are brought about by the delay in the last division of two of the nuclei in the ascus and the using up of most of the cytoplasm by the first-formed spores, or by more than one nucleus being enclosed in the developing spores. Both coloured and colourless ascospores are capable of germination: when little nutriment is present secondary conidia are produced, whereas when there is abundant food-material the spores give rise directly to a mycelium.

When the bark has been completely permeated by the fungus, the mycelium collects between the outer bark and the thin covering of cork and forms shallow stromata, on which the apothecia are formed later. Before this, however, numerous pycnidia occur. These are irregular in shape and, arising beneath the lenticels, split the cork at these points. The conidia emerge as black, pasty, rounded masses or pustules on the surface of the bark, which harden on exposure to air. The conidia are very similar in appearance to the ascospores and behave in a similar way on germination. Fuckel wrongly associated this stage with *Ulocolla foliacea* Bref.

## Order II. PYRENOMYCETES.

The distinguishing character of this order is that the asci are enclosed in flask-shaped structures known as *perithecia*. These may be borne directly on the mycelium and free from each other, or may be embedded in a fleshy, corky, or carbonaceous mass called a *stroma*; the stromata are of various shapes and in certain tropical species attain a considerable size.

The surface of the stroma is often at first clothed with asexual conidia. Also, accompanying or preceding the ascigerous condition, there is frequently present a *pycnidium* or *spermogonium* stage in which spores are borne on pedicels (not in asci) within a flask-shaped fruit-body (fig. 1, H).

### CLI. CORDYCEPS Fr.

(Greek *kordule,* a club.)

The stroma is erect, fleshy, stipitate, with a fertile clavate or spherical head, in which the perithecia are more or less immersed; the spores are linear and multiseptate, soon falling apart at the septa. Growing principally on dead insects, but also on subterranean fungi.

Owing to their peculiar habit, earlier writers regarded various species as insects which changed into plants. Watson, describing a West Indian species of "vegetable fly" in 1763, writes: "In the month of May it buries itself in the earth and begins to vegetate. By the latter end of July the tree arrives at its full growth and resembles a coral branch, and is about three inches high and bears several little pods, which, dropping off, become worms and from thence flies, like the English caterpillar." Several Australasian species are of a large size and are popularly known as "vegetable caterpillars." The best known of these, *C. Robertsii*, occurs principally in New Zealand, usually growing singly from the head of the larva of *Porina*. When fully grown it is from six to fifteen inches in height. (The sclerotia are made use of in tattooing, being burnt, pulverised, and mixed with water: the powder is not used for the face, as it is not sufficiently black.) An Australian species, *C. Taylori*, is about the same size, but is repeatedly branched like the antler of a deer, three to six growing in a cluster.

Another well-known species is *C. sinensis*- a celebrated drug in the Chinese Pharmacopœia ("Summer plant, winter insect"). It is brought to Canton in bundles of a dozen or so, tied up with silk thread. According to some authorities it is sold as food, but the usual statement is that the fungus is so rare, being found in Thibet and outlying parts of the Empire, that it is only used by the emperor's physicians; black, old, and rotten specimens are said to be worth four times their weight in silver.

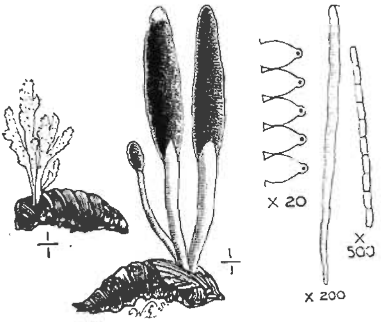


Fig. 133.—*Cordyceps militaris* Fr. Perithecial (right) and conidial (left) stages, nat. size: perithecia, ×20; ascus, ×200; portion of septate spore, ×500.

198. **C. militaris** Fr. (Latin *militaris*, soldier-like.)

Yellowish red or crimson, clavate, narrowed at both ends, usually single, sometimes cæspitose; head minutely tuberculose from the openings of the somewhat superficial perithecia; stem smooth.

On pupæ and caterpillars in damp woods. Common. Autumn. 2×1.

The perithecial stage is preceded by a conidial stage (*Isaria farinosa*); this is white, plume-like, subcæspitose, about an inch high, with a distinct, simple, glabrous stem and thickened, more or less branched upper portion powdery with the spores. Germination of the spore takes place on the surface of the skin of the caterpillar, and the germ-tube penetrates the cuticle and body-wall. Inside the body-cavity the germ-tube branches, forming hyphæ which permeate all parts of the body. Longish cylindrical spores are formed, partly at the extremities of the primary branches and partly on short lateral branches. These pass at once into the blood which fills the cavity of the body, where they elongate, divide repeatedly by transverse walls, and then increase by budding. They grow at the expense of the blood, which diminishes in quantity to such a degree that the insect at last loses its normal turgidity, becomes soft and relaxed, and in this state dies. The fungus-cells then send out copiously branching hyphæ, which grow in dense clusters throughout the body, forming a hard compact mass, the cuticle and sometimes the alimentary system alone remaining intact. Infection of the host may occur from the germ-tube of either an ascospore or a conidium. Conidia may germinate and the hyphæ live saprophytically on decaying organic substances, such as wood, for a considerable time—the hyphæ on coming in contact with a host are capable of entering the tissues. The mycelial mass inside the dead pupa has the property of a sclerotium and produces stromata in a few weeks' time, if in a moist habitat. The stromata vary considerably in size, shape, and number, according to the nature and habitat of the host.

199. **C. capitata** Fr. (Latin *capitatus*, having a head.)

Head ovato-globose, yellowish brown, red-brown, or black, minutely rough from the projecting mouths of the perithecia; stem usually lemon-yellow, smooth, at length blackish and fibroso-strigose.

Parasitic on *Elaphomyces granulatus* and *E. variegatus* (see p. 197). Woods. Not uncommon. 4×⅓.

**C. ophioglossoides** Link.—Differs from No. 199 in the reddish-black clavate head and the olive S. Parasitic on *Elaphomyces granulatus*, *E. muricatus*, and *E. variegatus*. Woods. F. 4×¼.

## CLII. HYPOCREA Fr.

(Greek *hupo*, somewhat, *kreas*, flesh.)

The stroma is fleshy, usually pulvinate, hemispherical or flattened, sometimes erect, sometimes very reduced and floccoso-fibrous; the perithecia are usually only partly immersed; the spores are typically uniseptate, the two portions, which are generally spherical, soon breaking apart at the septum so that the ascus appears to contain sixteen spores. Growing on decayed fungi, on wood, or on the ground.

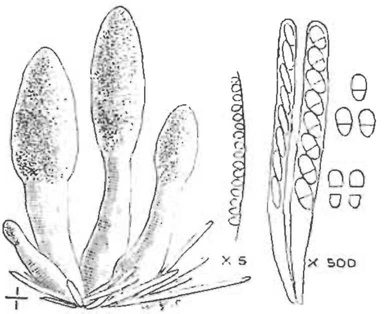


Fig. 134.—*Hypocrea alutacea* Fr. (Nat. size); perithecia. × 5; asci and spores, × 500.

**200. H. alutacea** Fr. (Latin *alutaceus*, like tanned leather.)

Whitish, then pale yellow or tan colour, erect, with a clavate or irregular head, slightly villose, then smooth, minutely tuberculate from the brownish mouths of the perithecia, confluent, with the stout or slender stem of variable length and usually somewhat lighter in colour; flesh white.

Among leaves and on rotten wood in fir woods. Summer and autumn. Not uncommon. $1\frac{3}{4} \times \frac{1}{2}$.

There has been much controversy concerning the structure of this fungus. Earlier observers regarded it as an autonomous species, but Tulasne, noting the similarity of the perithecia to those of the genus *Hypomyces* and on account of the somewhat anomalous erect habit, considered them as being parasitic on some *Clavaria*, such as *C. ligula*. Later workers added *Spathularia* spp. and *Cudonia circinnans* as hosts. Atkinson, however, proved that the fungus was truly possessed of an erect stroma by cultivating it from the spores.

## CLIII. HYPOMYCES Tul.

(Greek *hupo*, below, *mukes*, fungus—from its habit.)

The perithecia are membranous with a short conical mouth, often brightly coloured, immersed in, or more rarely seated on, the stroma, which is a web of floccose or thread-like mycelium, usually of the same colour as the perithecia. Mostly parasitic on Basidiomycetes.

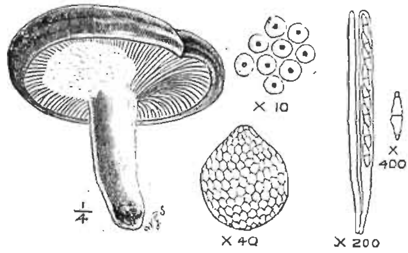


Fig. 135.—*Hypomyces lateritius* Tul., on the gills of *Lactarius deliciosus* (× ¼); perithecia, × 10 and × 40; ascus, × 200; spore, × 400.

The perithecium is almost always accompanied or preceded by a conidial stage (*Verticillium*, *Diplocladium*, *Dactylium*, etc.) or (and) a chlamydospore stage (*Mycogone*, *Sepedonium*, *Stephanoma*, etc.).

201. **H. lateritius** Tul. (Latin *lateritius*, brick-coloured.)

Mycelium white, powdery with the conidia, becoming pale yellow or yellowish brown, more or less cottony, forming an even layer over the gills of the host and obliterating them, more rarely on the stem; perithecia yellowish or brownish, darker than the subiculum, ovate, immersed, or with the necks more or less prominent.

On *Lactarius deliciosus*. Common.

The wood-cut shows the spores wrongly as septate. The spore-contents often migrate to one end and give the appearance of septation. The brick-red colour is only attained in very old and dried specimens, and is due principally to the colour of the host.

**H. torminosus** Tul.—Stroma forming a thin white floccose layer on the G. of the host, gradually becoming pale yellow, then honey-coloured, and eventually, when dry, assuming a chocolate-brown hue; perithecia honey-coloured, papillate, papillæ darker. On *Lactarius torminosus*. F.

**H. chrysospermus** Tul.—Stroma commencing as a small area of effused white mycelium, first producing microconidia, rapidly spreading and penetrating the host, and producing the *Sepedonium* stage, which is at first faintly tinged yellow, then golden yellow; perithecia rare, hyaline, then golden-yellow, crowded. On *Boletus spp.*, *Paxillus involutus*, etc. C.

The host is permeated by the parasite, and becomes reduced to a mass of golden-yellow powder, which falls to pieces on being touched.

**H. aurantius** Tul.—Stroma white, effused, producing conidia, then orange or rust colour, often white at the circumference; perithecia golden-yellow or orange, crowded, subconfluent, with strongly-protruding ostioles. On *Polyporus spp.*, *Trametes*, and the tougher agarics. F.

**H. rosellus** Tul.—Stroma white, thin, of open texture, producing conidia, then rose-coloured, except at the sterile margin; perithecia deep rose-red. On *Stereum hirsutum* etc. C.

**H. asterophora** Tul.—Stroma fawn-coloured, first producing cylindrical conidia; perithecia pale yellow-brown, subhyaline, immersed in the stroma, crowded, sessile, sphæroid, viscid, with a more or less elongated neck and acute ciliate ostiole, upon or within the S. of *Nyctalis*.

The conidia of *Nyctalis* were previously regarded as the chlamydospores of this species (see p. 111).

## CLIV. XYLARIA Hill.

(Greek *xylon*, wood—from the texture.)

The fruit-body is black, erect or ascending, stipitate, cylindrical, clavate or filiform, often compressed, simple or branched, and corky or leathery in consistency; the perithecia occupy the upper portion of the fruit-body, and are immersed with the mouths usually projecting. Usually growing on or near wood.

The young stroma is at first covered with conidiophores, giving rise to a white coating of conidia.

202. **X. polymorpha** Grev. (Greek *polymorphos*, multiform.)

Fruit-body whitish cinereous, then black, solitary, or from two to six connate at the base, either clavate or cylindrical, somewhat attenuate above and below, or obovate, compressed, subdigitately divided or irregular, very variable in size; head rough with the papilliform ostioles of the perithecia; stem very short; flesh white.

Gregarious on old stumps. Common. Jan. to Dec. 2 × 1.

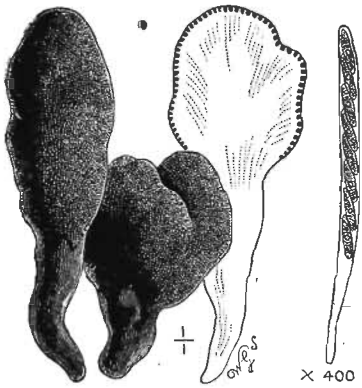


Fig. 136.—*Xylaria polymorpha* Grev. and section (Nat. size); ascus, × 400.

Many varieties of this fungus have been described, but apparently the majority, if not all, of these are merely *growth-forms*, *variations* of temperature and other climatic factors playing a more important part in the production of polymorphism than do differences in the matrix.

The fungus is perennial, the base of the previous year's stroma acting as a sclerotium, out of which the new fruit-body develops as a lateral cylindrical growth. Guégen has shown that the growing stroma is strongly positively heliotropic, and that the reaction is indispensable for the formation of conidia.

**X. hypoxylon** Grev. (Candle-snuff fungus.)—Stroma erect, simple or branched, round or compressed, lanceolate, woolly tomentose at the base; head white at first, then black and rough from the prominent, thickly crowded perithecia, apex sterile; stem short, distinct. On and about old stumps. C. $2\frac{1}{2}$ in. high.

Guégen has shown that here, as in the previous species, the old stroma acts as a sclerotium. The stroma reacts positively towards light, the receptive region being a short distance from the apex. A developing stroma will grow *towards a lateral source of light as a thin cylindrical rod more than three* times the usual length of the stroma. Light is necessary for the production of conidiophores and conidia. The young mycelium is luminous, but loses this property as it ages. This observation confirms that of Ludwig and others, but is contrary to the experience of Molisch (*cf.* p. 8). It seems likely that *X. hypoxylon*, like many other fungi, may be resolved into a number of strains, and that only certain of these exhibit luminosity.

## CLV. PORONIA Willd.

(Greek *poros*, pore.)

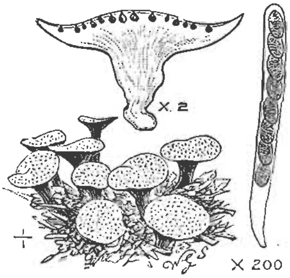


Fig. 137.—*Poronia punctata* Fr. (Nat. size): section, × 2; ascus, × 200.

The fruit-body is erect, and fleshy to corky in consistency, at first clavate, then becoming cup-shaped or discoid, a fertile disc punctate with the projecting mouths of the immersed, black carbonaceous perithecia being borne on a short stem.

203. **P. punctata** Fr. (Latin *punctatus*, perforated.)

Fruit-body black externally, turbinate, stipitate; disc greyish white, at first pulverulent with conidia, becoming black punctate with the ostioles of the perithecia, the papilliform ostioles protruding at maturity; stem dilating into the disc, usually very short, often hidden in the substratum; flesh white.

Gregarious on old horse-dung. Uncommon. Autumn. $\frac{1}{2} \times \frac{1}{2}$.

When any part of a developing stroma is cut off, a new stalk arises from the cut-surface.

## CLVI. **HYPOXYLON** Bull.

(Greek *hypoxylos*, wooden beneath.)

The fruit-body is globose, semiglobose, or more or less effused and crustaceous, free from the first or erumpent, then superficial, sometimes sunk in the wood, dark brown or black within and without, woody to corky in consistency; covered with conidia at first, then naked; the perithecia are peripherally arranged and immersed. Growing on wood.

204. **H. coccineum** Bull. (Latin *coccineus*, scarlet.)

Fruit-body bright brick-red when mature, subglobose, erumpent-superficial, solitary or subconfluent; perithecia peripheral, forming a single layer, slightly prominent and giving the fruit-body a somewhat rough appearance; flesh brownish black.

On bark of dead deciduous trees, principally beech. Common. Summer and autumn. ½ in. diam.

The stroma is at first covered with olivaceous conidia, which later become yellowish or brownish. When growing on damp logs the young stroma is often seated on fairly long radiating branched tufts of flattened olivaceous-brown conidiophores, which are covered with subhyaline conidia; this is *Isaria umbrina* Pers.

## Order III. TUBERACEÆ.

The Tuberaceæ are typically subterranean fungi, and are usually globose or irregular in shape. Their wall is fleshy or leathery, and may be entirely closed or possess a small opening. The interior of the fruit-body is hollow, cavernous, or solid.

The asci in certain forms (*Elaphomyces* etc.) are scattered in the tissue of the fruit-body, and are not arranged in a definite hymenium: in other cases (*Balsamia* etc.) there is a definite hymenium lining the walls of chambers which are closed to the exterior, whereas in the main group (*Tuber* etc.) the hymenium lines the walls of interior tubes which are open to the exterior and are either hollow or more or less filled with hyphæ. In this last group the flesh is usually marbled in appearance. There are two kinds of veins, usually of different colours. Sterile veins (venæ externæ), which are extensions of the inner layer of the peridium to the interior of the fungus, alternate with fertile veins (venæ internæ), which are lined throughout by the hymenium.

**Development.**—A study of the development of *Tuber puberulum* and *Choiromyces meandriformis* has shown that the young fruit-body is open at first, and that the hymenium becomes internal by invagination; the peridium is a secondary formation, finally closing over the point where the fertile veins are in communication with the exterior.

## CLVII. **ELAPHOMYCES** Nees von Esenbeck.

(Greek *elaphos*, a stag; *mukes*, a fungus.)

The fruit-body is irregularly globose or depressed, and often has a well-developed covering of mycelium; the wall is usually thick and composed of two layers; the asci are at first regularly arranged in nest-like groups separated by sterile veins, which run chiefly in a radial direction. When ripe the interior is filled with a powdery

spore-mass containing a few hyphæ (capillitium); the spores are dark-coloured, spherical, with thick walls, the outer layer of which is composed of short radial rods.

Certain species of *Elaphomyces* have been considered to be associated with the roots of pines and other trees to form mycorrhiza.

**E. anthracinus** Vitt. (1).—Pe. clothed at first with dark brown mycelium, black or blackish brown, smooth to the naked eye, subglobose, often with a rounded dimple in the middle, hard when dry; spore-mass blackish brown. Smell weak of radish. Subterranean in woods. R. 1½ in. diam.

**E. variegatus** Vitt. (2).—Pe. yellowish to reddish brown, with crowded small *pointed pyramidal warts*, outer layer of wall ochraceous or golden, inner layer reddish brown and veined; when young surrounded by an envelope of hyphæ and roots; spore-mass black when ripe with greyish veins: smell of garlic. Subterranean in woods. C. 1 in. diam. Often parasitised by *Cordyceps capitata* and *C. ophioglossoides* (see p. 192).

When the spores of *C. ophioglossoides* germinate they give rise to hyphæ which grow over *Mnium hornum*, a moss which possesses numerous rhizoids that penetrate the soil to a depth at which the *Elaphomyces* grows. The moss becomes covered with the yellowish mycelium of the *Cordyceps*, which follows the rhizoids under ground, and thus is able to reach the *Elaphomyces* if it happens to be present.

**E. granulatus** Fr. (3).—Differs from 2 in its minute rounded warts and in the inner layer of the Pe. wall not having veins. Subterranean in woods. C. 1½ in. diam. Often parasitised by *Cordyceps capitata* and *C. ophioglossoides*.

## CLVIII. GENEA Vitt.

(After J. Gené, a friend of Vittadini.)

The fruit-body is globose or irregular, verrucose or papillose, hollow or with small cavities which open below an apical pore, base generally fibrillose; asci cylindrical with eight colourless, ellipsoid, verrucose spores.

**G. verrucosa** Tul. (4).—Pe. black or brown, irregularly lobed or grooved, with small polygonal flattened warts; basal fibrils brown, short; hymenium yellowish white; odour strong, disagreeable. Clay soil. F. 1 in. diam.

**G. Klotzschii** B. & Br. (5).—Differs from 4 in the more irregular shape and smaller warts; basal fibrils brown, few, rigid; mycelium white. Under leaves. R. ¾ in. diam.

**G. sphærica** Tul. (6).—Differs from 4 in being subglobose with long, ferruginous, well-developed, basal fibrils. Calcareous woods. R. ¾ in. diam.

**G. hispidula** Berk. (7).—Pe. blackish brown, densely covered with brown hairs, globoso-depressed, verrucose: basal filaments brown; internal cavity simple; odour weak. Underground under chestnut. O. ½ in. diam.

## CLIX. SPHÆROSOMA Klotzsch.

(Greek *sphaira*, sphere; *soma*, body.)

The fruit-body is irregularly globose and rather fleshy, entirely closed or with a small apical opening, hollow or cavernous; the asci are cylindrical with eight hyaline or slightly coloured spherical, reticulate, echinulate, or verrucose spores.

*Sphærosoma* differs from the other genera of the Tuberaceæ in structure, and is best classified with the Discomycetes.

**S. ostiolatum** Tul. (8).—Pe. brown, glabrous, deformed, hollow, pierced at the summit by a small ostiole. Under leaves. R. ½ in. diam.

## CLX. BALSAMIA Vitt.

(After J. Balsamo, Professor at Milan.)

The fruit-body is fleshy, finely papillose or verrucose, imperforate, cavernous; the asci are oblong or ovoid with eight colourless, elliptic-oblong, smooth spores.

**B. vulgaris** Vitt. (9).—Pe. ferruginous, irregularly grooved, minutely papillose or almost smooth; interior whitish to yellowish, containing white milk, traversed by numerous irregular cavities; odour unpleasant when ripe. Under trees. R. 1½ in. diam.

**B. platyspora** B. & Br. (10).—Differs from 9 in its larger size, its more irregular, warted Pe., and the comparatively few cavities, which are frequently stuffed. Under trees and bushes. R. ¾ in. diam.

**B. fragiformis** Tul. (11).—Pe. reddish to violet-brown, densely covered with small polygonal warts, globose, hirsute in places, and often with a basal mycelial tuft; interior yellowish white, cavities numerous, small. In clay soil. R. ¾ in. diam.

## CLXI. HYDNOBOLITES Tul.

(Greek *hudnon*, a truffle; *boletes*, a fungus.)

The fruit-body is wrinkled or folded, and seated on a mycelium; the gleba is fleshy with small sinuous cavities open to the exterior.

**H. cerebriformis** Tul. (12).—Pe. whitish and pubescent, then yellowish and smooth, wrinkled, folded; interior white, then yellowish brown; asci elliptic-oblong, with eight yellowish, globose, reticulate spores. Under moss and leaves. O. 1 in. diam.

**H. Tulasnei** B. & Br. (13) (*Hydnotrya*).—Pe. ferruginous or bay, minutely tomentose, then smooth, globoso-depressed, with plicate base, folded and pitted; interior whitish to yellowish; asci elliptic-oblong with eight brown, globose, coarsely-warted spores. In sandy soil. F. 2 in. diam.

## CLXII. STEPHENSIA Tul.

(After H. O. Stephens, a British mycologist.)

The fruit-body is irregularly globose and tomentose; the interior is traversed by two kinds of veins, and becomes cavernous and deliquescent; opening at the base; the asci are cylindrical, with eight colourless, spherical, smooth spores.

**S. bombycina** Tul. (14).—Pe. minutely whitish or yellowish downy, then yellowish brown, subglobose, depressed; interior yellowish with white veins. Subterranean in damp places. O. ½ in. diam.

## CLXIII. PACHYPHLŒUS Tul.

(Greek *pachus*, thick; *phloios*, cortex.)

The fruit-body is subglobose or depressed, sometimes lobed, generally with a distinct base, opening usually apical and more or less well-defined; the interior is traversed by two kinds of veins; the asci are clavate with eight coloured, spherical, warted spores.

**P. melanoxanthus** Tul. (15).—Pe. greenish yellow, then black, subglobose, with a distinct base, covered with polygonal warts; interior greyish green to dark brown, with yellow or greenish veins. In humus. F. ¾ in. diam.

**P. citrinus** B. & Br. (16).—Differs from 15 in the Pe. being citron-yellow on a brown ground and furfuraceous, with the apex a darker bright citron and the interior brown with citron or dark yellow veins. Underground in woods. R. ½ in. diam.

**P. conglomeratus** B. & Br. (17).—Pe. brownish red or olive-brown, with silky yellow fibres, especially in the depressions, irregularly lobed and plicate as if formed of a number of individuals, shortly stipitate, smooth. Underground in woods. F. 1 in. diam.

## CLXIV. TUBER Mich.

(Latin *tuber*, a swelling.)

The fruit-body is irregularly globose, fleshy, or leathery, with a smooth or warted peridium; the interior has two kinds of veins, which frequently give it a marbled appearance; the asci are globose-ovoid and contain usually one to four coloured, reticulate or spiny, ellipsoid or spherical, large spores.

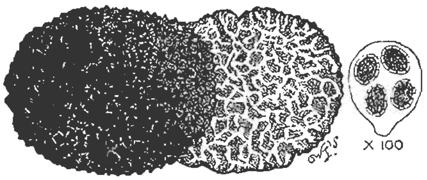


Fig. 138.—*Tuber æstivum* Vitt. and section (Nat. size); ascus, × 100.

Truffles occur principally in calcareous soils, and appear to be rare or absent from sandy soil. They are usually associated with the roots of trees, and are consequently generally regarded as obtaining a portion of their nutriment therefrom, either parasitically or saprophytically. In France they occur principally under the evergreen oaks, *Quercus Ilex* and *Q. coccifera*, though they are found frequently under *Q. sessiliflora*, hazel, and beeches; in this country beeches have been found the most prolific. The soil of truffle-grounds is poor in undergrowth, and the edges of the woods are the most profitable hunting-grounds. Truffles are best if they have been caught by the first frosts of winter, but when frozen are spoiled. Truffles have been esteemed since classical times, and are mentioned by Theophrastus, Pliny, Juvenal, Plutarch, and others. Several kinds were known to the Greeks and Romans, and one of the current opinions was that they were formed during thunderstorms. Pliny regarded them as amongst the most wonderful of all things, as they sprang up and lived without a root.

It is usually understood that truffles, probably *T. æstivum*, came into use in the courts of France and Italy some time prior to the fourteenth century. *T. melanosporum* seems to have made its entrance into Parisian cookery towards the close of the fifteenth century.

*Collecting.*—Owing to the fact that truffles are usually hidden, either under leaf-mould or earth, often to a foot underground, there is considerable difficulty in finding them. On account of the scent of truffles, certain animals are customarily used for their detection. Where truffles are not unusually abundant, dogs are employed. As a rule, these are trained from puppyhood, and, though all breeds are used, the most favoured in France is a small poodle, the essential being that the dog should possess a good nose and be docile. On scenting a truffle the dog approaches, stops, and begins to scratch the ground; if the fungus be deeply buried it is not usual to allow the dog to exhaust itself by scratching, but the rabassier (from *rabasso*, the Provençal word for truffle) digs it up with a short fork. The reward is almost universally a piece of bread and cheese, but

Vittadini relates that he possessed a dog so well trained that it became possible to obtain one subterranean species rather than another by varying the reward. Formerly there was a considerable traffic in truffle-hunting in Sussex and Wiltshire, the dogs employed being mongrel terriers. *T. æstivum* was sold usually at two and three shillings a pound. There is still a small amount of hunting done, but the trade is said to have been ruined by the taxation of the dogs. It is more likely, however, that the preference for the Périgord truffle, and its greater abundance, have ousted the summer truffle from the markets.

Nees von Esenbeck records that in his neighbourhood there lived a poor infirm boy who scented truffles better than the best dog, and so earned a livelihood.

Where truffles are more frequent pigs are used, almost invariably sows, as they are superior and more docile. The pig is fond of the truffle, and seeks it naturally, but is said to require a couple of years for proper training. Great care is taken of the animals, and they are carried to distant hunting-grounds in carts.

Both dogs and pigs are most successful when the ground is moist during dry weather and drizzling rains fewer truffles are found. A third method of detection is by taking note of the habitat of the so-called "truffle-fly," *Anisotoma cinnamomea*, the larvæ of which live in truffles. The beetle is usually taken by "sweeping" in the evening. On noting the beetle, the scent of the truffle and sometimes cracks in the earth are usually sufficient to reveal the fungus.

France is practically the only country in which the truffle is an article of commerce; about one-third of the supply is exported. The allied forms, *terfas* or *kames*, which occur principally in Mediterranean regions (though *Terfezia lævis* occurs in the New Forest), are apparently restricted to siliceous soils. Native Arabs collect them by noting slight bulging and breaking of the soil around the roots of the plants under which they grow.

*Cultivation.*—Numerous attempts have been made in the south of France to cultivate the truffle, and many of the forest truffle-areas were formerly barren of these fungi. The most successful method is to plant oaks or other trees under which truffles are known to occur, arrange proper drainage, and exclude squirrels and other predatory animals. Soil from truffle-regions is also frequently scattered over the surface of the ground. Older methods were by moistening the soil with water in which the skins of truffles had been rubbed or by manuring with truffle-parings.

205. **T. æstivum** Vitt. (22). (Latin *æstivus*, of summer.)

Fruit-body glistening bluish black when fresh, brownish black when dry, subglobose or irregular with base sometimes lacunose, covered with large, hard, pyramidal or four-sided furrowed and ribbed warts with depressed apex and striate across, finally splitting along the angles; interior white, then ochraceous, and when ripe brownish with whitish branched and labyrinthine veins; odour slight, pleasant.

Subterranean in woods, especially beech. Not uncommon. Autumn and winter. 1–4 in. diam.

This is the best of the British species from a gastronomic point of view, but is not held in such high esteem as *T. melanosperum*, the French truffle, which is used in *paté de foie gras* and *poulard truffé*. Neither the latter nor the garlic-scented *T. magnatum*, which is much used in Italy, have yet been found in this country.

**T. mesentericum** Vitt. (23).—Differs from 22 in the black Pe. with smaller, not transversely striate warts, and in the gleba being finally brownish grey with veins showing as dark lines when fresh. Subterranean in woods. R. 3 in. diam.

**T. brumale** Vitt. (25). Differs from 22 in the smaller, sloping, polygonal warts with excavated apex crested with points, in the white then violet to cinereous grey or violet-brown gleba with white veins; Pe. reddish when young; smell strong. Subterranean in woods. O. 2 in. diam.

**T. macrosporum** Vitt. (19).—Differs from 22 in the black to rust-coloured Pe. with small, flat, pyramidal warts or polygonal areas, in the white then purple-brown or blackish gleba with white, then brownish veins, and in the odour of onions. Subterranean usually in clay soil. O. 2 in. diam.

**T. puberulum** B. & Br. (24).—Pe. white, then greyish yellow, and finally light reddish brown with white patches, somewhat lobed; interior isabelline, then reddish or yellowish brown, with a few white veins; odour of radish. Subterranean in sandy soil. F. ¾ in. diam.

**T. dryophilum** Tul. (20).—Pe. white downy, then brownish, with reddish-violet patches; interior whitish, then vinous or purplish, with branched veins, hard. Subterranean under oaks and poplars. O. 1½ in. diam.

**T. maculatum** Vitt. (21).—Pe. snow-white, then with yellow patches, and finally golden yellow, smooth, globoso-mammilate; interior whitish, then reddish brown, with white veins. Subterranean in woods. O. 1 in. diam.

**T. excavatum** Vitt. (18).—Pe. ochraceous, then reddish brown, smooth, then minutely papillose, subglobose or irregular, with a basal indentation; interior whitish, then ochraceous, and finally brown, with yellowish white veins, hard; smell of radish. Subterranean in woods. O. 1½ in. diam.

**T. rufum** Pico (26).—Pe. reddish brown, tesselated or verrucose, sometimes irregular, horny, interior reddish brown with numerous white, sinuous, obscure veins. Subterranean or partly exposed, in woods. F. 1½ in. diam.

**T. nitidum** Vitt. (27).—Differs from 26 in the smooth, somewhat polished, reddish-yellow Pe. Subterranean in woods. F. ¾ in. diam.

## CLXV. CHOIROMYCES Vitt.

(Greek *choiros*, pig; *mukes*, fungus.)

The fruit-body is globose or irregular, with a distinct base, and smooth naked surface; the flesh is white or coloured with numerous veins; the asci are oblong-ovate, with coloured, globose, warted spores.

206. **C. meandriformis** Vitt. (28). White Truffle. (Latin *Mæander*, a winding river; *forma*, form.)

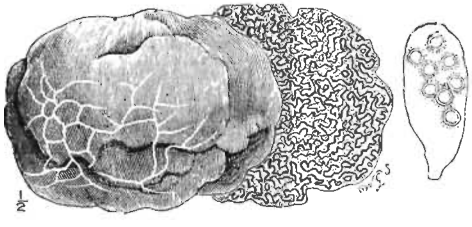

Fig. 139.—*Choiromyces meandriformis* Vitt. and section (× ½); ascus, × 100.

Fruit-body cream-white, then tawny or chestnut, often nodulose or irregular in form, with plicate base, surface smooth, strongly shrivelled when dry, often divided by lighter lines into irregular areas; flesh white when fresh, yellowish or light brown when dry, becoming darker with age. Oak plantations. Usually half-buried. Not uncommon. Summer and autumn. 5 in. diam.

# MYCETOZOA*.

Mycetozoa, Myxomycetes, or slime fungi are represented by two models, although they cannot be regarded as fungi, their affinities being with the Protozoa. Spores are formed in sporangia (except in the genus *Ceratiomyxa*). The spores are provided with a firm wall, and on germination produce an amœboid swarm-cell, which soon acquires a flagellum; no mycelium is produced at any stage of the life-history. The motile swarm-cells multiply by division; later they withdraw their flagella and become amœboid, and subsequently fuse together to form a plasmodium. The plasmodium finally gives rise to fruits, which consist of a supporting structure and spores.

## CLXVI. **FULIGO** Hall.

(Latin *fuligo*, soot—from the appearance.)

The fruit-body is composed of elongated, branching, and interwoven sporangia, combining together to form a large cushion-shaped mass; the outer layer of sporangia is often barren, forming a thick but fragile crust, containing lime-granules.

207. **F. septica** Gmel. (Greek *septikos*, putrefying.) Flowers of Tan.

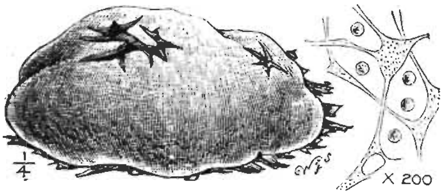


Fig. 140.—*Fuligo septica* Gmel. (× ¼); spores and capillitia, × 200.

Plasmodium yellow. Sporangial groups yellow, pinkish, dull white, or reddish brown; sporangial walls within the group very fragile, colourless, with scattered innate deposits of lime; capillitium of hyaline threads with yellow or whitish lime-knots; spore-mass purple.

On rotten wood, tan, etc. Summer. Common. 8 in. diam.

The fruit-bodies vary much in size, in colour, and in the amount to which the cortex is developed.

This is probably the most abundant and most widely distributed of all Mycetozoa. It frequently occurs on heaps of spent tan in tan-yards, and is often a great nuisance in hot-houses where tan is used, sometimes completely covering it and stopping the growth of the plants.

## CLXVII. **LYCOGALA** Mich.

(Greek *lukos*, wolf; *gala*, milk.)

The fruit-body is subglobose or conical, formed of sporangia, enclosed by a definite cortex consisting of two or more closely combined layers, and provided externally with cell-like vesicles.

* A collection of British Mycetozoa, to which there is a special guide, is shown in the table-case adjoining the models.

208. **L. epidendrum** Fr. (Greek *epi*, upon; *dendron*, a tree.)

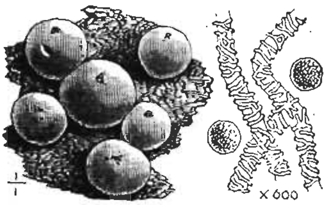


Fig. 141.—*Lycogala epidendrum* Fr. (Nat. size); spores and capillitia, × 600.

Plasmodium coral-red, rarely cream-colour or yellow. Fruit-body at first rose-red, maturing to pinkish grey, yellowish brown, red-brown, or nearly black, subglobose, sessile, crowded or scattered, minutely warted; cortex varying in thickness, minutely warted with superficially arranged vesicles; pseudocapillitium arising from all parts of the inner side of the cortex in the form of loosely branching and anastomosing thin-walled tubes usually marked with close transverse ribs; spore-mass pinkish grey or pink.

On dead wood. Common. Summer and autumn. ½ in. diam.

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# GLOSSARY*

Acuminate (*acuminatus*), having a long tapering point.
Adnate (*adnascor*, to grow to), of gills broadly attached to the stem (fig. 4, C).
Adnexed (*ad*, to, *necto*, to join), of gills which just reach the stem (fig. 4, B).
Agglutinate (*agglutino*, to glue), adhering as if with glue.
Alveolate (*alveolus*, a little vessel), marked with depressions like a shallow honeycomb.
Amorphous (Gr. *a*, without, *morphe*, form), shapeless.
Amphigenous (Gr. *amphi*, around, *genos*, offspring), growing all round: the hymenium not restricted to one surface.
Anastomosing (Gr. *anastomosis*, an opening from one sea to another), united by running together irregularly.
Annulus, a ring round the stem (fig. 2, D); Annular, in the form of a ring; Annulate, having a ring.
Apiculate (*apiculum*, a little point), furnished with a short sharp point.
Apophysis (Gr. *apo*, from, *phuo*, to grow), a swelling on the stem present in some species of *Geaster*.
Appendiculate (*appendicula*, a small appendage), hanging in small fragments.
Applanate (*ad*, to, *planatus*, made flat), flattened.
Arachnoid (Gr. *arachne*, a spider's web, *eidos*, resemblance), like a cobweb.
Arcuate (*arcus*, a bow), of gills, bow-shaped.
Areolate (*areola*, a small area), divided into small areas or patches.
Ascus, pl. Asci (Gr. *askos*, a wine-skin), the structure containing spores in Ascomycetes (figs. 1, B, & 122).
Atomate, sprinkled with small particles.

Basidium, pl. Basidia (*basidium*, a little pedestal), the spore-bearing structure in Basidiomycetes (figs. 1, A, & 2).
Bi-, Bis-, in compound words meaning "twice."
Bifid (*bis*, twice, *findo*, to cut), divided halfway into two.
Bistre, a warm-brown colour.
Bullate (*bulla*, a bubble), furnished with a boss or stud.
Byssoid (*byssus*, fine flax), composed of fine threads.

Cæspitose (*cæspes*, a clump), growing in tufts like grass.
Campanulate (*campanula*, a little bell), bell-shaped.
Canaliculate (*canaliculus*, a little channel), with a longitudinal channel or groove.
Capitate (*caput*, a head), having a head.
Carnose (*caro*, *carnis*, flesh), fleshy.
Cartilaginous (*cartilago*, cartilage), hard and tough.
Cerebriform (*cerebrum*, the brain), having an irregular brain-like appearance, as the kernel of a walnut.
Chlamydospore (Gr. *chlamus*, *chlamydos*, a cloak, *spora*, a seed), a spore with a very thick membrane.
Ciliate (*cilium*, an eyelash), fringed with hairs.
Cinereous (*cinis*, *cineris*, ashes), the grey of wood ashes.
Cinnabarine (Gr. *kinnabari*, a red pigment), scarlet.
Circumscissile (*circum*, round, *scindo*, to split), splitting in a circle.
Clamp-connections, projections growing out from a cell and fusing with the adjoining cell (see p. 15).
Clavate (*clavus*, a club), club-shaped.

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* "Gr." signifies Greek; other derivations are from Latin.

COLUMELLA (a small pillar), the small columnar base of barren tissue in certain Gasteromycetes.
CONCHATE, CONCHIFORM (*concha*, a shell), shell-shaped.
CONCOLOROUS (*concolor*, of one colour), uniform in tint.
CONCRETE (*concretus*, growing together), as when scales adhere to the flesh of the pileus.
CONIDIUM, pl. CONIDIA (Gr. *konis*, dust), an asexual spore (see p. 5).
CONNATE (*connatus*, born at the same time), united by growing together.
CONNIVENT (*connivens*, winking), coming into contact or convergent.
CORIACEOUS (*corium*, leather), leathery.
CORTEX (bark or rind), the outer skin; CORTICATE, having a cortex.
CORTINA (a curtain), a veil of spider-web-like structure, as in *Cortinarius*.
COSTATE (*costa*, a rib), ribbed or veined.
CRENATE (*crena*, a notch), with rounded notches; CRENULATE, with small rounded notches.
CRUSTACEOUS (*crusta*, rind), of brittle texture.
CUPULATE (*cupula*, a little cup), cup-shaped.
CUTICLE (*cuticula*), the outer skin.
CYATHIFORM (Gr. *kuathos*, a wine-cup), shaped like a drinking-cup.
CYSTIDIUM (Gr. *kustis*, a cavity), a sterile cell, often inflated, projecting beyond the basidia and paraphyses in the hymenium of Basidiomycetes.

DECOLOURED (*decolor*), deprived of colour.
DECUMBENT (*decumbens*), reclining, but with the summit ascending.
DECURRENT (*decurrens*, running down), of gills etc. running down the stem (fig. 4, E).
DEFLEXED (*deflexus*, bent aside), bent outwards.
DEHISCE (*dehisco*, to yawn), to open spontaneously when mature.
DELIQUESCENT (*deliquescens*, melting away), becoming fluid when mature.
DENTATE (*dens*, *dentis*, a tooth), toothed; DENTICULATE, minutely toothed.
DEPAUPERATE (*depauperatus*), undeveloped, as if starved.
DEPRESSED (*depressus*), sunk down (fig. 4, G).
DETERMINATE (*determinatus*), definite.
DICHOTOMOUS (*dichotomus*, forked), forking in pairs.
DIGITATE (*digitus*, a finger), fingered.
DIMIDIATE (*dimidiatus*, halved), when one half of an organ is smaller than the other.
DISCIFORM (*discus*, a quoit), circular and flat.
DISCOLOURED (*discolor*), of a different colour.
DISCRETE (*discretus*, parted), separate, not coalescent.
DISSEPIMENT (*dissepimentum*, a partition), dividing wall.

ECHINULATE (*echinus*, a hedgehog), with short bristles.
EFFUSED (*effusus*, poured out), expanded.
EMARGINATE (*e*, out of, *margo*, the margin), of gills with a sudden curve as if scooped out at the point of attachment to the stem.
ENDOGENOUS (Gr. *endo*, within, *genos*, offspring), produced inside another body.
ENDOPERIDIUM (Gr. *endo*, within), the inner layer of the peridium.
EPIPHRAGM (Gr. *epi*, upon, *phragma*, a fence), the closing membrane of the sporophore in Nidulariaceæ.
EPIPHYLLOUS (Gr. *epi*, upon, *phullon*, a leaf), growing on leaves.
EPIPHYTE (Gr. *epi*, upon, *phuton*, a plant), a plant which grows upon other plants, but not parasitically.
EPISPORE (Gr. *epi*, upon), the outer coat of a spore.
ERUMPENT (*erumpens*, breaking through), bursting through the surface of the substratum.
EVANESCENT (*evanescens*, vanishing), lasting only a short time.
EXCENTRIC (*ex*, out of, *centrum*, the centre), one-sided.
EXOGENOUS (Gr. *exo*, outside, *genos*, offspring), produced on the outside of another body.

EXOPERIDIUM (Gr. *exo*, outside), the outer layer of the peridium.
EXSERTED (*exsertus*, protruded), protruding beyond.

FACULTATIVE (*facultas*, capability), occasional, incidental, as opposed to obligate.
FARINACEOUS, FARINOSE (*farina*, meal), mealy.
FASCICULATE (*fasciculus*, a little bundle), growing in bundles.
FASTIGIATE (*fastigium*, a slope, gable), with parallel clustered and erect branches.
FERRUGINOUS (*ferrugo*, rust), of the colour of iron-rust.
FIBRILLOSE (*fibrilla*, a small fibre), clothed with small fibres.
FILIFORM (*filum*, thread), thread-like.
FIMBRIATE (*fimbria*, fringe), fringed.
FISTULOSE (*fistula*, a pipe), hollow, like a pipe.
FLABELLIFORM (*flabellum*, a fan), fan-shaped.
FLOCCI (*floccus*, a lock of wool), tufts resembling cotton; FLOCCOSE, woolly; FLOCCULOSE, finely woolly.
-FORM (*forma*), shape.
FREE, of gills which reach the stem, but are not attached to it (fig. 4, A).
FULIGINOUS (*fuligineus*), soot-coloured.
FULVOUS (*fulvus*), tawny.
FUNDAMENT (*fundamentum*, ground-work), initiation.
FUNICULUS (*funis*, a rope), a cord of hyphæ in the Nidulariaceæ attaching the peridioles to the inner wall of the peridium.
FURCATE (*furca*, a fork), forked.
FURFURACEOUS (*furfur*, bran), scurfy.
FUSIFORM (*fusus*, a spindle), spindle-shaped.

GIBBOUS (*gibbus*, humpbacked), of a pileus with a swelling or broad umbo, or convex above and flat below.
GILLS, of Agaricaceæ, the lamellæ or plates which bear the hymenium (fig. 2, B, B).
GLABROUS (*glaber*, without hairs), smooth.
GLEBA (*clod*), the internal tissue in Gasteromycetes and Tuberaceæ.
GREGARIOUS (*gregarius*, belonging to a flock), growing in company, but not joined together.
GUTTATE (*gutta*, drop), with tear-like drops.
GYROSE (*gyrosus*), curved backward and forward in turn.

HABIT (*habitus*, appearance), the general appearance.
HABITAT (*habitatio*, dwelling), the place of growth.
HETEROGENEOUS (Gr. *heteros*, other, *genos*, offspring), not uniform in structure.
HISPID (*hispidus*), beset with rough hairs or bristles.
HIRSUTE (*hirsutus*), beset with long hairs.
HOMOGENEOUS (Gr. *homos*, one and the same, *genos*, offspring), uniform in structure.
HYALINE (*hyalinus*, of glass), colourless, translucent.
HYGROMETRIC (Gr. *hugros*, moist, *metron*, measure), moving under the influence of moisture.
HYGROPHANUS (Gr. *hugros*, moist, *phaino*, to appear), of a watery appearance when moist.
HYMENIUM (Gr. *humen*, a membrane), the layer composed of the spore-bearing organs.
HYMENOPHORE (Gr. *humen*, a membrane, *phoreo*, to carry), the structure bearing the hymenium; the sporophore.
HYPERTROPHY (Gr. *huper*, above, *trophe*, food), an abnormal enlargement of an organ.
HYPHA, pl. HYPHÆ (Gr. *huphe*, a web), the thread-like element of which fungi are composed.

IMBRICATE (*imbrex*, *-icis*, a tile), overlapping as the tiles on a roof.
IMMARGINATE (*im*, not, *margo*, *-inis*, a border), without a distinct border.

INCRASSATED (*incrassatus*), thickened.'
INFERIOR (lower) of the annulus, low down on the stem.
INFUNDIBULIFORM (*infundibulum*, a funnel), funnel-shaped.
INNATE (*innatus*, natural), adhering by growing into.
INVOLUTE (*involutus*, enwrapped), rolled inwards.
ISABELLINE (Mod. Lat. *isabellinus*), a dirty-tawny tint.

LACINIATE (*lacinia*, the flap of a garment), divided into flaps.
LACUNA, a hole or depression; LACUNOSE, having lacunæ.
LAMELLA (a thin plate), the gills or plates which in Agaricaceæ bear the hymenium.
LATEX (juice), milky juice; LACTIFEROUS, having latex.
LENTICULAR (*lens*, *lentis*, a lentil), lentil-shaped.
LIGNICOLOUS (*lignum*. wood, *colo*, to inhabit), growing on wood.
LIVID (*lividus*), pale lead-colour.
LUNATE (*luna*, the moon), half-moon shape.
LURID (*luridus*, sallow, wan), dingy brown or yellow.

MAMMIFORM (*mamma*, the breast), breast-shaped.
MARGINATE (*margo*, the edge or boundary-line of a body). having a distinct border.
MEMBRANOUS, MEMBRANACEOUS (*membranaceus*), thin and semi-transparent.
MUCEDINOUS (*mucedus*, mouldy), mould-like.
MULTI- (*multus*), many.
MYCELIUM (Gr. *mukes*, a fungus), "spawn"; vegetative hyphæ.

OB-, prefix meaning inversely or oppositely.
OBCONIC (*ob*, *conus*, a cone), inversely conical.
OBOVATE (*ob*, *ovatus*, egg-shaped). inversely ovate.
OBSOLETE (*obsoletus*, worn out), wanting or rudimentary.
OBTUSE (*obtusus*), blunt or rounded at the end.
OCHREOUS, OCHRACEOUS (*ochra*, yellow earth), yellow with a tinge of red.
-OID (Gr. *eidos*, resemblance), a suffix meaning like.
OIDIUM, pl. OIDIA (Gr. *oon*, an egg, *idion*, a diminutive), square-ended asexual spores formed in chains.
OPERCULUM (a lid), a cover.
OSTIOLE (*ostiolum*, a little door), the aperture through which the spores escape in certain genera.
OVATE, OVOID (*ovum*, egg), egg-shaped.

PALLID (*pallidus*, wan), somewhat pale.
PALMATE (*palma*. the palm of the hand), lobed in a finger-like manner.
PAPILLA (a nipple), a nipple-like elevation.
PARAPHYSIS, pl. -ES (Gr. *para*, beside, *phusis*, growth), sterile filaments in a hymenium.
PARTIAL (*partialis*, pertaining to a part), of a veil, extending from the margin of the pileus to the stem.
PATELLIFORM (*patella*, a small dish), dish-shaped.
PATENT (*patens*), spreading.
PECTINATE (*pecten*, a comb), like the teeth of a comb.
PEDICEL (*pediculus*, a small foot), a small stalk; PEDICELLATE, having a small pedicel.
PELLICLE (*pellicula*, a small skin), a delicate superficial membrane.
PELTATE (*pelta*, a small shield), target-shaped.
PENICILLATE (*penicillus*, a little brush), pencil-shaped.
PERIDIOLUM (diminutive of peridium), the rounded bodies in Nidulariaceæ, which contain the spores.
PERIDIUM (Gr. *peridion*, a little pouch). outer membrane in Gasteromycetes etc.
PERISTOME (Gr. *peri*, about, *stoma*, mouth), a fringe around the orifice in certain Gasteromycetes.

PERITHECIUM, pl. PERITHECIA (Gr. *peri*, about, *theca*, a case), the flask-shaped structure which in Pyrenomycetes contains the asci.
PERONATE (Gr. *pero*, a boot), with a thick woolly covering.
PERVIOUS (*pervius*, passable), having a passage through.
PILEUS (cap), the cap-structure bearing the hymenium in Agaricaceæ.
PILOSE (*pilus*, a hair), covered with hairs.
PLANE (*planus*, level), even, flat.
PLASMODIUM (Gr. *plasma*, that formed), the mass of naked nucleated protoplasm in the Mycetozoa.
PLICATE (*plico*, to fold), folded into plaits.
PLUMOSE (*pluma*, a feather), feathered.
PLUR-, PLURI-, used as a prefix for many, or several.
POLY- (Gr. *polus*), many.
POLYMORPHIC (Gr. *polus*, many, *morphe*, form), having different forms.
PRIMORDIUM (the beginning), an organ in its earliest condition.
PROTOPLASM (Gr. *protos*, first, *plasma*, moulded), the viscous living substance in plants.
PRUINOSE (*pruina*, hoar-frost), covered with frost-like bloom.
PUBESCENT (*pubes*, down), slightly hairy.
PULVERULENT (*pulver*, powder), powdered, as if dusted over.
PULVINATE (*pulvinus*, cushion), cushion-shaped.
PUNCTATE (*punctum*, a point), dotted with points.
PYRIFORM (*pyrus*, a pear), pear-shaped.

RACEMOSE (*racemus*, a bunch of grapes), borne in a bunch.
RADIATE (*radius*, the spoke of a wheel), spreading from a centre.
RECEPTACLE (*receptaculum*, a reservoir), an axis bearing one or more organs, as the stem in Phalloidaceæ; also used for any hymenium-bearing structure.
REFLEXED (*reflexus*), bent back.
REMOTE (*remotus*, distant), of gills which do not reach the stem, but leave a free space around it.
RENIFORM (*renes*, the kidneys), kidney-shaped.
REPAND (*repandus*), bent backwards.
RESUPINATE (*resupinatus*, bent back), with hymenium upwards.
RETICULATE (*rete*, a net), netted.
REVOLUTE (*revolutus*, rolled back), rolled backwards.
RHIZINA, (Gr. *rhiza*, a root), root-like hairs, or strands.
RHIZOMORPH (Gr. *rhiza*, a root, *morphe*, shape), a root-like strand of compacted mycelium.
RIMOSE (*rima*, a cleft), cracked.
RIVULOSE (*rivulus*, a rill), marked with lines like rivulets.
RUBIGENOUS (*rubigo*, rust), rust-coloured.
RUDIMENT (*rudimentum*, a first attempt), the earliest condition of an organ.
RUFOUS (*rufus*), reddish: RUFESCENT, becoming red.
RUGOSE (*rugosus*), wrinkled; RUGULOSE, somewhat wrinkled.

SCABROUS (*scaber*), rough.
SCISSILE (*scindo*, to cleave), capable of being cleft asunder.
SCLEROTIUM, -A (Gr. *skleros*, hard), a compact mass of hyphæ in a dormant state.
SCROBICULATE (*scrobiculus*, a little trench), marked with small pits.
SEPARATING, becoming detached.
SEPTUM (hedge or enclosure), a cell-wall or division; SEPTATE, having septa.
SERRATE (*serra*, a saw), toothed like a saw; SERRULATE, minutely toothed.
SESSILE (*sessilis*, sitting), without a stem.
SETA, a bristle.
SIMPLE (*simplex*), unbroken; unbranched; undivided.
SINUATE (*sinus*, a curve), waved; of gills with a sudden curve before reaching the stem.
SPATHULATE (*spatha*, a spatula), spoon-shaped
SPINULOSE (*spina*, a thorn), bearing fine spines.

SPORANGIUM, pl. SPORANGIA (Gr. *spora*, a seed, *aggeion*, a vessel), an organ containing an indefinite number of spores.

SPORES (Gr. *spora*, a seed), the analogues of seeds in flowering plants.

SPOROPHORE (Gr. *phoreo*, to carry), the fruit-body.

SQUAMOSE (*squama*, a scale), scaly.

SQUAMULE (*squamula*), a small scale; SQUAMULOSE, beset with small scales.

SQUARROSE (*squarrosus*, rough), rough with scales.

STELLATE (*stella*, a star), star-shaped.

STERIGMA, pl. STERIGMATA (Gr. *sterigma*, a prop), the portion of the basidium bearing the spore.

STIPE (*stipes*), a stalk; STIPITATE, stalked.

STRIATE (*stria*, a furrow), marked with fine lines, grooves, or ridges.

STRIGOSE (*striga*, a swathe), rough with sharp-pointed hairs, hispid.

STROMA (Gr., a mattress), a cushion-like body in which the perithecia are immersed in many Pyrenomycetes.

STUFFED, of a stem of which the interior is filled with a substance of different texture from that of the walls.

SUB-, prefix, signifying under, below, or partly.

SUBICULUM (an under-layer), the more or less densely felted mycelium covering the substratum from which the fruit-bodies arise.

SUBULATE (*subula*, a small weapon), awl-shaped.

SULCATE (*sulcus*, a small groove), marked with grooves.

SUPERIOR (higher), of an annulus near the apex of the stem.

TERETE (*teres*, rounded), circular in transverse section, cylindric, and usually tapering.

TERRICOLOUS (*terra*, earth, *colo*, to inhabit), growing on the ground.

TESSELLATE (*tessellatus*, of squared stones), chequered.

TETRA (Gr. *tetras*), four.

TOMENTUM (stuffing), pubescence; TOMENTOSE, downy.

TRAMA (Gr., weft), the tissue between the hymenium in gills etc.

TREMELLOID (*Tremella*, *eidos*, resemblance), like jelly in appearance.

TRIQUETROUS (*triquetrus*), three-edged.

TRUNCATE (*truncatus*, shortened), ending abruptly as though cut off at the end.

TUBERCLE (*tuberculum*, a little tuber), a small wart-like protuberance; TUBERCULATE, TUBERCULOSE, having tubercles.

TURBINATE (*turbinatus*, cone-shaped), top-shaped.

UMBILICATE (*umbilicus*, navel), with a small central depression.

UMBO (the boss of a shield), a central elevation of the pileus; UMBONATE, having an umbo (fig. 4, F).

UNIVERSAL (*universalis*, pertaining to the whole), of the veil or volva entirely enveloping the young sporophore.

URCEOLATE (*urceolus*, a little pitcher), hollow and contracted at the mouth like a pitcher.

VEIL (*velum*, an awning), the outer envelope in the Agaricaceæ within which development takes place.

VENOSE (*vena*, a vein), having veins.

VENTRICOSE (*ventricosus*), inflated on one side.

VERRUCOSE (*verruca*, a wart), warty.

VERSIFORM (*versiformis*, changing shape), of different shapes, or altering in shape with age.

VESICULOSE (*vesicula*, a small bladder), as if composed of bladders.

VILLOSE, VILLOUS (*villus*, a shaggy hair), downy with soft hairs.

VINOUS (*vinum*, wine), of the colour of red wine.

VIRGATE (*virga*, a twig, stripe), streaked.

VISCID (*viscidus*), clammy.

VOLVA (a wrapper), the tissue enveloping the young sporophore usually ruptured at the apex, leaving a cup-shaped structure at the base of the stem.

ZONE (*zona*), a girdle.

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